

MODEL ENGINEER

Vol. 187 No. 4159

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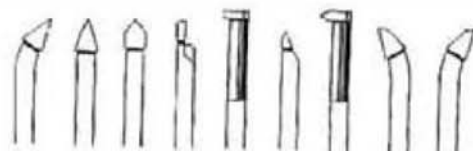
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In company with visitors with more
 conventional narrow gauge engines,
 a pair of East African Railways Class 59
 locomotives in 7¹/₄in. gauge dominate
 proceedings at the picturesque
 Weston Park Miniature Railway.
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A GHOST STORY ST BRUNO PLUG

A conflagration is avoided and wise
 advice is implied.
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Dealing with the electronics, making
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NEW SERIES: BUILDING A MINIATURE UNIVERSAL LATHE

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TRADE TOPICS:

New products of interest to the
 model engineer.
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On the cover ...

25 years on and together again at last!
 Neil Simkins and Richard Coleby
 at the controls of their 7¹/₄in. gauge
 versions of East African Railways
 Class 59 locomotives,
 Mount Kenya and Mount Kilimanjaro
 on the picturesque and challenging
 Weston Park Railway
 near Telford in Shropshire.
 Those involved tell the fascinating stories
 of the railway and the locomotives
 in our special feature in this issue,
 beginning on page 478.
 (Photograph by Mike Chrisp)

WEIGHT DRIVEN EGG TIMER

Continuing with valuable hints for the
 novice, work on the frame is completed
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 grace any kitchen wall. Part IV.
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LINING AND LETTERING

Advice on using the special pen
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 the views of a novice user. Part III.
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NEW SERIES: BURRELL - A STEAM TRAM

Designed for 3¹/₄in. gauge and inspired
 by an illustration of one of only two
 prototypes, this fun project is based
 around LBSC's Tich design. Part I.
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OLIVER EVANS' HALF-BEAM ENGINE

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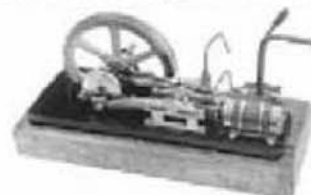
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5"G	Pansy	0-6-0	3.1/2"G	P.V. Baker	0-6-0
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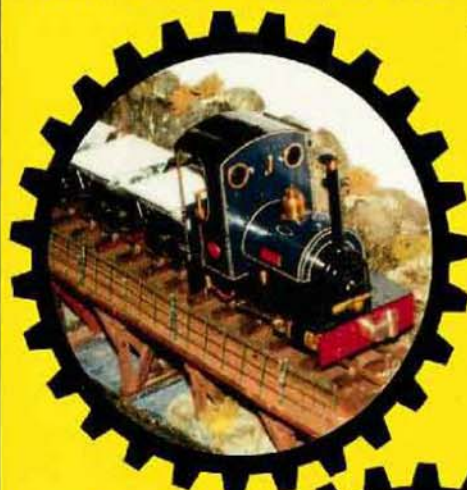
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A Great Book and Project for the New Year! (no castings required.....)

The Tesla Disc Turbine [Cairns] £ 6.80 inc U-K Post & Packing



The Croatian born inventor Nikola Tesla is best known today for the Tesla Coil and for sitting under a gigantic version of one as it spewed high voltage lightning around him, but on a more sensible level he invented the AC electrical system almost universally used today. One of his inventions, which he

patented, is the subject of this book and had nothing to do with electricity, other than as a possible means of generating it. This was his *Disc Turbine* for which a British Patent, which also covered a compressor variant, was granted in 1910. Unlike a conventional turbine, in which the rotor consists of bladed segments, in Tesla's machine these were replaced by discs, working on the concept of flowing media being converted to rotary motion by friction working on the discs. Tesla claimed that a very small, but extremely powerful machine was possible using this principle - in fact his aim was to produce a 25 hp machine that would fit inside a bowler hat.

A number of experimental machines were built, the largest producing 500 kw, all using steam as the media, and as single machines without condensers. Whilst they all worked well they were ahead of the metallurgy of the time, as the very high centrifugal forces caused the discs to stretch and this, coupled with lack of funds prevented further development, the *Parsons* and *Curtis* types of turbine reigning supreme up till the present day, with Tesla's type being largely forgotten.

Intrigued by references he came across to Tesla's ideas, John Cairns started investigating and this book is the result. In it he describes in detail the concept, and the history, of the original engines. He then proposes a number of uses such turbines could be used for, including car and light aircraft use, all of which illustrate the extraordinary versatility of Tesla's idea. Finally he provides the design and building instructions for a small Tesla turbine, which any model engineer should be able to build.

Not only does a Tesla Turbine provide a very high power to size ratio, it can be used as a compressor or pump, as well as a prime mover. Tesla used steam on his test machines, and the model featured here would probably be run on compressed air, but the gas turbine principle can also be used; this really is a remarkably versatile machine. This versatility means that ninety one years after the original Patents were granted there are signs of re-awakened interest in Tesla's turbine, as many of the original problems can be overcome with modern materials. What is really exciting at this stage is that, rather as with the revival of the *Stirling* Cycle engine, this revival can be materially boosted by individual experimenters. This book is the place to start! High quality. 34 A4 format pages. Numerous drawings and sketches, including 6 pages of drawings specifically for a small Tesla turbine you can build. Paperback.



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For all new policies or renewals, we can recommend to our readers specialist broker Walker Midgley Insurance Brokers Ltd. Walker Midgley have years of expert experience in providing Select Insurance Cover for Individual Modellers & Model Engineers, as well as Model Road Steam Insurance including full Road Traffic Act cover. In addition to their excellent menu of cover, readers will be pleased to learn that the business is owned by active modeller Tony Wood, a leading figure with the Northern Association of Model Engineers.

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SMOKE RINGS

With the Editors

Coach trips to MEX 2001

In this column in M.E. 4156, 16 November 2001, we published the fact that John Elver is organising return coach trips from Bristol, Cardiff and Exeter to Sandown Park Exhibition Centre each day of the Model Engineer Exhibition. Most regrettably, an incorrect contact telephone number was given.

If you wish to take advantage of this very convenient mode of travel, please make your bookings or direct your enquiries to John Elver on 01179-693119, not the number as previously published.

Our apologies to all who have been inconvenienced by this error, not least to John and the owner of the number originally published!

MEX 2001 Free Prize Draw

Chronos UK Ltd. in St Albans is conveniently close for me to be able to call in on Mark Smith, Proprietor of this Aladdin's Cave to top up my tooling and materials requirements, to gain an update on what's new in the trade and to gather an insight on how things are in the model engineering supply business. On a recent visit, I learned from Mark that he has set aside a lathe for a Free Prize Draw at the 71st Model Engineer Exhibition at Sandown Park Exhibition Centre 29 December 2001 – 1 January 2002.

The lathe, which weighs 6kg, is illustrated in the accompanying photograph and is the ever-popular MJ-189A. This lathe has a 46mm centre height (92mm swing over bed), is 200mm between centres with 52mm cross-slide travel, and the spindle is bored 10.2mm diameter. The 95W drive motor is continuously rated and gives a range of speeds between 130-4000rpm.

Visitors to MEX 2001 will find two Free Prize Draw boxes at the show, one at the entrance and the other on the Chronos stand. The draw will take place towards the end of the Exhibition on Tuesday afternoon 1 January 2002 when the lucky winner can collect his prize.

Chronos UK is at Unit 8, Executive Park, 229/231 Hatfield Road, St Albans, Hertfordshire AL1 4TA; tel: 01727-832793; fax 01727-848130; email: sales@chronos.ltd.uk; online catalogue: www.chronos.ltd.uk

John Wilding at MEX 2001

Roger Drake, Proprietor of RiteTime Publishing wrote recently to say that not only will his company have a stand at the 71st Model Engineer Exhibition, but that our respected contributor John Wilding, pictured right, will be present for its duration. John is looking forward to meeting constructors of his clocks and others who may wish to learn more about his publications, which are now available from RiteTime Publishing. John will also be demonstrating gear cutting on a small lathe.

Representing this new company and promoting John Wilding's clock construction books, Roger says that he is looking forward to meeting the many friends and constructors John has come to know during the considerable number of years that he has been writing his books.

Alongside the books on the RiteTime Publishing stand will be a display of John's clocks including the Egg Timer, currently being described in these pages, and his latest work, the conversion of a Galileo movement to a weight driven clock with automatic winding. John's Crystal Wheel Skeleton Clock and his Large Wheel Skeleton Clock will be displayed as loan models in the Exhibition.

RiteTime Publishing are at 18 Woolmer Way, Bordon, Hampshire GU35 9QF; tel: 01420-487747; fax: 01420-474647.

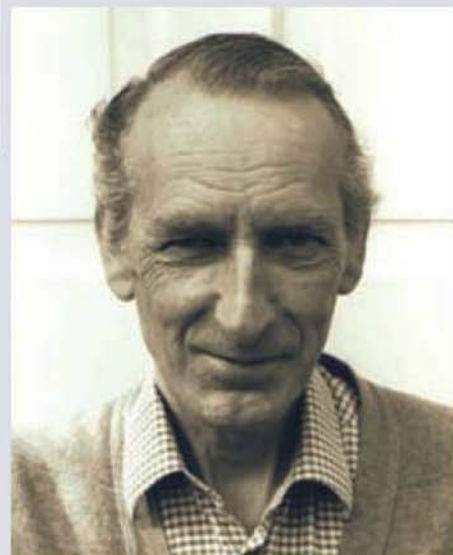
The Fedden papers

Andrew Nahum of the Science Museum in London wrote recently as follows:

"With respect to the interesting series by David Boote on unusual engine configurations, readers may like to know that the 'as yet unfound' Fedden papers are in fact lodged with the Bristol branch of the Rolls-Royce Heritage Trust.

"The papers came to us some years ago when I suggested that Cranfield University loan to us the then incomplete Fedden flat 6 Sleeve Valve engine. This came with a variety of parts. It was re-assembled in our Conservation workshops and is now on display in the Flight gallery here.

"With it also came a large crate of unsorted Fedden's papers and drawings, presumably given to Cranfield because of his pivotal role in getting the original College of Aeronautics established, and his position as a Governor. These we passed to the RRHT at Bristol with Cranfield's permission



John Wilding will be pleased to meet fellow enthusiasts on the RiteTime Publishing stand at MEX 2001 29 December 2001 - 1 January 2002.

because of the Trust's association with sleeve-valves and, of course the Fedden connection. Importantly, too the Trust also had the resources to order and list the material. The contact there is Peter Pavey on 01179-795256."

Village Press

We have just learned from Kathy Erlewein, Editorial Assistant with Village Press that Joe Rice has retired from his position as editor of *Home Shop Machinist* and *Machinist's Workshop* magazines. Neil Knopf is now the editor of both publications. All future mailings should be addressed to Neil Knopf, Editor, Home Shop Machinist (or Machinist's Workshop), PO Box 629, Traverse City, MI 49685, USA; tel: (231) 946-3712.

I am quite sure that I speak for many when I record here our thanks to Joe for his dedication to the magazines of which he has been Editor for many years, and wish him a long, healthy and happy retirement.

We welcome Neil Knopf to the post and hope he derives much pleasure and satisfaction from his new role.

Stanley steam car

Peter Turvey in Middlesex recently wrote seeking help from Antipodean readers of M.E.:

"I wonder if any Australian readers of Model Engineer magazine know of the family of the Rev'd Henry Brown of Ballygally, Co. Antrim in Northern Ireland who emigrated to Australia in about 1960.

"Rev'd Brown wrote at least one article about steam cars for M.E. in the 1940s and I believe he was interested in large scale model railway locomotives too. We have recently acquired a 10hp Stanley steam car which was owned by Rev'd Brown until 1951 and would like to make contact with his family to ask if any early photographs or details of its history survive.

"The car has been stripped down for restoration and is very original."

Any reader(s) able to assist in this matter are invited to reply to Peter Turvey directly by email to pturvey@aol.com or via the Model Engineer Editorial Office, PO Box 310, Hemel Hempstead, Hertfordshire, HP3 8AX: fax: 01442-269366. Replies by email to sarah.white@nexusmedia.com will also be forwarded promptly.



Mark Smith of Chronos UK will present this MJ-189A lathe, list price £299, to the lucky winner of their Free Prize Draw at MEX 2001 29 December 2001 - 1 January 2002.

POST BAG

My cousin's mill

SIRS, - The following is a true story, told to me by my cousin about himself. He too is a model engineer who lives by himself with just a small feisty terrier for company. I hadn't seen him for some time and 'phoned him to hear what he had been up to. We made an arrangement to meet. On the day I arrived the rain was torrential; I rang the doorbell, the door was opened and his dog made every effort to remove my lower leg or worse! My cousin assured me that she was really quite harmless, and welcomed me in.

We spent the next couple of hours consuming tea and talking about engines, with me placating the dog by throwing her ball up the hallway. Eventually I was asked: would I like to see his workshop? My cousin had previously mentioned a new machine tool that he had got hold of, so I was quite keen to have a look at it. Out into the rain we went, he unlocked the workshop door and in we piled, but not the dog. She just stood out in the rain with her head and tail down, looking very different from the way she had met me at the front door. I called to her but she just stayed out in the rain. "She won't come in" said my cousin and with a wave of his arm sent the dog back. I noticed the dog basket under the bench and pointed "It looks like she stayed in here." I said "She used to" he replied, his expression changed and he began to tell me the story.

I have only ever heard two ghost stories which I am inclined to believe, and this is one of them. My cousin had purchased a second hand horizontal bench milling machine and had installed it at the far end of his long narrow workshop. He was working away with the dog in her basket under the bench as usual, when he said he felt he was no longer alone. He looked up. "The hair on the back of my neck stood up" he said, "there standing in front of the milling machine was an elderly white haired old gentleman in a brown cow-gown." Apparently the dog yelped and fled into the yard and my cousin said he wasn't far behind!

He locked the door and stayed out for some time, eventually summoning up the courage to go back in after three months. He hasn't seen the old gent since, and I was aware of nothing; in fact I might have thought he had imagined it except for the profound change in

the dog from a fearless little fighter to a very cowed animal

when confronted by the open workshop door. My cousin said he thought the man must have been the previous owner of the milling machine since it wasn't his father, who had kept his black hair to the end. He didn't believe in ghosts ... but now he's not so sure!

Next time you buy second hand equipment, be sure to look after it, you never know when the previous owner is going to come round checking up on you!

Merry Christmas.

John Welch
Staffordshire.

C. I. Wilson

SIRS, - As a regular reader of this magazine, I know full well just how extensive is the depth of knowledge possessed by the readership.

I am trying to discover what happened to C. I. Wilson who were making boilers for model engineers in Liverpool about ten years ago. Is Mr. Wilson still in business? If so, where is he now?

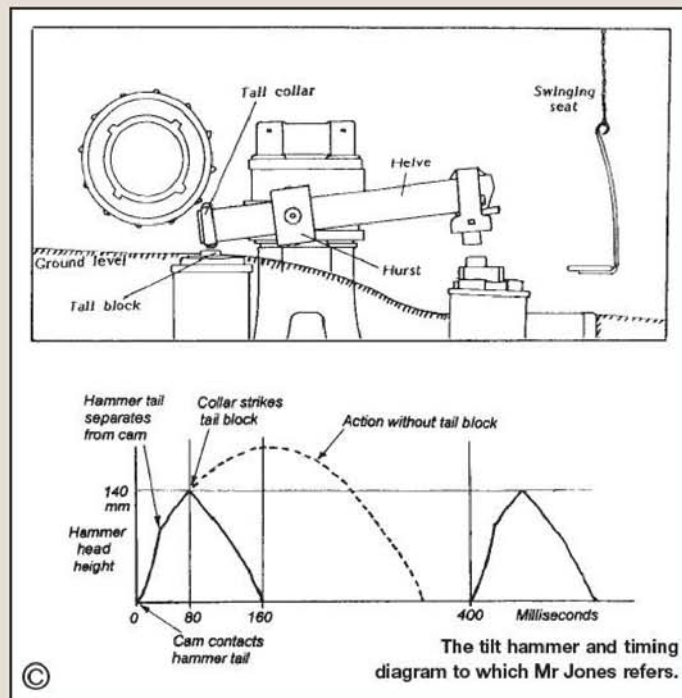
C. I. Wilson was highly regarded at the time and I would very much appreciate any help in making contact with this company.

Colin Heard
1 Kermode Close, Crosby,
Isle of Man IM4 4BS

Turns

SIRS, - The item shown on p320, M.E. 4156, 16 November 2001 and which puzzled Mr Dickenson will be instantly recognised by anyone with even a passing interest in horology. I'm surprised that no-one in the office recognised this commonplace item. Anyone even remotely concerned with clocks and/or watches is likely to have a set or know someone who has. It is a set of 'turns' used to turn watch parts such as wheels and, more often, pinions and balance staffs. A much larger version used for clocks is known as a set of 'throws'.

The description states that "... the tailstock on the left is fixed to the bar ...", in fact the fixed element is the equivalent of the headstock of a conventional lathe while the movable element is the tailstock. The turns are held in the vice by clamping under the headstock end, which is why that part has a lip on either side of the bed to rest upon the vice jaws. The photograph shows the T-rest, used to support the hand graver while turning, has been mounted the wrong way round; it should be towards the camera for



normal right-handed use. Maybe the original owner was left handed and used the turns reversed.

The workpiece is carried on a runner mounted between the two stocks and is rotated by bowing with a horsehair bow, similar to a violin bow, the cut being made by the hand graver on the downturn of the bow while the workpiece was rotating towards the operator.

Ian Broadbent, by e-mail.

Tilt hammers

SIRS, - In the article on Abbeydale Works published in M.E. 4150, 13 July 2001, some statements are made about the operation of tilt hammers which are not quite correct.

The cams lifted the hammer by depressing its tail, but it did not just fall by gravity. It was thrown up against a spring, which contributed greatly to its return. This was to enable the hammer to operate at a higher speed.

Belly helve hammers used an overhead beam as a spring, but the tilt hammer had no separate part for it. The spring function must have been provided by the helve, when its tail was thrown down against the tail block. The action is shown in the timing diagram, from measurements made on the plating hammer at Middle Mill, Belbroughton. Also, the quoted speed of 6 blows per minute for the steeling hammer is far too low. It should be about 270 per minute, which is more than 4 blows per second. The plating hammer was slower, at only 150 per minute.

The hammers shown at the bottom of page 25 are displayed in the open because they were brought from another site. They were never used at Abbeydale. Only one of this pair is a tilt hammer; the other is a nose helve, a very slow hammer

used in the production of wrought iron. It is the only type which does not have any spring action.

David H. Jones
Surrey.

Differential valve gear

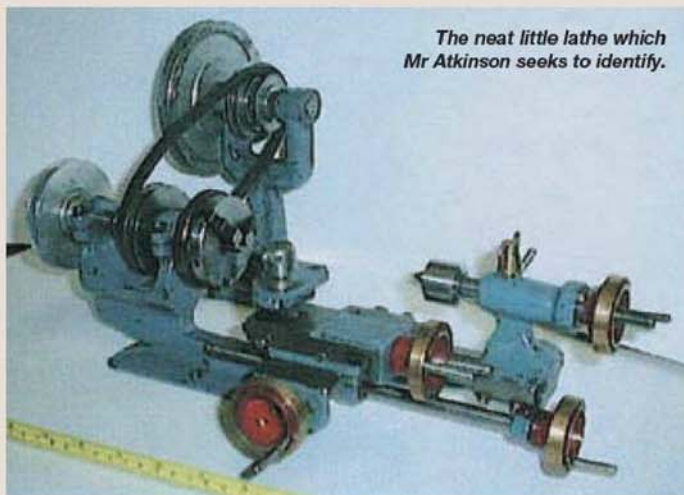
SIRS, - With reference to the recent letters concerning Maudsley's valve gear, your correspondents may be unaware of the *Sujen* valve gear, which was described in M.E. 3990, 7 April 1995. This also is based on the differential principle, but has the great advantage of being compact and readily enclosed in an oil bath casing; also the timing may be altered through a full 360deg., although obviously hardly necessary.

With the very simple addition of a spring loaded crank to drive the valve rod, with Westinghouse shaft governor geometry, 'notching-up' can be achieved automatically, with manual override if required.

While Mr. Briggs originated his boiler design no doubt with simplicity in mind, the firebox tube would seem to be of some concern, but has proved popular with Australian builders. It would be interesting to know if anyone in the UK has also used this boiler design.

While the Safer Steam System is also dependent on the integrity of a single tube, the volume of heated water involved is minute, whereas in contrast a burst firebox tube with the Briggs boiler capacity could be disastrous. A great improvement in both the building and maintenance of conventional boilers would appear to be the partial 'dryback' type, where the rear of the firebox is replaced by a removable plate, the loss of heating surface in this area being only of a minor order.

Cyril Cannell
Isle of Man.



The neat little lathe which Mr Atkinson seeks to identify.

Small lathe

SIRS, - I have recently purchased a small lathe which is fitted with a 3-jaw reversible Emco chuck that screws onto the spindle nose. There is 5 1/2 in. between the chuck and tailstock; this distance is reduced to 4 1/2 in. when a revolving centre is fitted. The centre height is 1 3/4 in. and the overall length is 14 3/4 in. The spindle is fitted with a cone V-pulley with diameters 2, 1 1/4 and 5/8 in. at the roots of the vees.

Any assistance in identifying this lathe would be much appreciated.

Peter Atkinson
N. Ireland.

Mike Chrisp suggests:

Looking rather like my own first lathe, a Super Adept, Mr Atkinson's lathe appears to be a typical, if small example of a machine produced in the first decades of the 20th century. Many were built to suit the requirements of small industry and home ownership, they were generally of fairly basic design and some were 'badged' for a retail outlet. Usually produced for sale at a comparatively low price, it was unusual for comprehensive literature to be published to accompany the machine. Neither did it necessarily follow that a range of accessories was available to enhance the versatility of the machine.

Readers with an interest in the subject and with access to the internet may wish to explore www.lathes.co.uk which carries a wealth of information on this and associated subjects. If literature was ever published, copies are likely to be available via this website. Those without access to this information may wish to contact Tony Griffiths directly at Wardlow, Buxton, Derbyshire SK17 8RP; tel: 01298-871633; e-mail: tony@lathes.co.uk

Martin Evans, Bulleid and sleeve valves

SIRS, - Mr. Evans has designed other than prototype locomotives, and which lack the ability to be scaled up to full size without look-

ing out of proportion. Conway if scaled up, would be ideal motive power for 'BB's' 'Forest of Bowland Light Railway' where the staff are gnomes about 3ft. 9in. high and would fit nicely under the cab. The tragedy is that this could so easily have been drawn out as the Manning Wardle 'Jubilee 1897'. Likewise, the odd looking William could have been drawn out accurately as an Egyptian State Railways locomotive and perhaps got a few inhabitants of that area into locomotive modelling. How many more would have been built if it had been offered as a 2-6-4 'River' tank? Simplex is not a typical industrial locomotive, quite the reverse, and a few minutes looking through one of the many publications on industrial locos would prove my point.

Freelance is only credible if the design will scale up to full size without looking ridiculous and I cite the superb Mustang illustrated in M.E. 1 August 1944 to shew what can be done. But why freelance at all, with all those wonderful prototypes out there waiting to be modelled?

Mr. Evans' condemnation of O. V. S. Bulleid and all his works is breathtaking in its arrogance. He totally ignores Mr. Bulleid's development work on the P1s, P2s and the A4s under Gresley, and the transformation of the 'Lord Nelsons' from good, if unpredictable performers, to a superb class of locomotive. His work on draughting and steam circuitry also improved many of the 'King Arthurs', culminating in the marvellous Red Knight which would do the work of a 'Nelson'.

Mr. Bulleid's boilers are probably the finest locomotive steam producers ever made in this country, with many innovative construction techniques being developed. The 'Q1' boiler enabled its improved 'Q' chassis to steam along on the poorest of coal, vital in the wartime conditions in which it was built.

Mr. Bulleid was not limited by convention or previous practice and introduced many detail improve-

ments on his Pacifics which Mr. Ron Jarvis retained on the 'Rebuilds' and were carried over to the 'Standards'. The 'Leader' boilers were almost certainly intended to reduce maintenance costs compared to a conventional boiler, following on from his widespread use of treated feedwater to the same ends on the Southern/Southern Region.

The great G. J. Churchward is said to have stated that "Any fool can get steam into a cylinder, but it takes a good man to get it out again." As usual, Mr. Bulleid was two jumps ahead of current thinking on this matter. With his practical experience on the LNER and being aware more than most of the potential value of poppet valves for the efficient distribution of steam, he was also fully aware of the even better potential of the sleeve valve with its rapid action and large port areas. Aircraft piston engines were going this way, so why not steam? Neville Evans has commented that he had been pulled around the skies for thousands of hours by Bristol Hercules and Centaurus sleeve valve engines which had benefited from the pioneer work of the early designers, and these fine power units had had a shaky start.

The efficient production of steam, started by the work of Churchward in the early 1900s and continued by the work of others from the 1930s when the genius of his work became recognised, has ceased to be much of a problem as long as the basic Stephenson boiler design is retained. The efficient use of steam still had a way to go when the steam locomotive was cast aside.

Thank Goodness there is always someone who wants to push forward the boundaries and cut through convention. Thank Goodness for the O. V. S. Bulleids, the Jim Ewins and the Keith Wilsons; one may not always see where they are going but they can really challenge you to think things out for yourself!

Regarding Mr. Evans' comments on the Daimler/Knight sleeve valve car engines, I spoke to Stafford East, Motor Engineer (GNs Akela and Tim 2) about them as he knew them in his younger days. He commented that they did smoke a lot from cold but that the smoke reduced when they warmed up. The sleeve valves needed the oil for lubrication due to the limitations of the engineering materials and tolerances of the time. Smoke emission was not unique to them and they were a reliable and long-lived design.

There is no argument that the Bulleid Pacifics raised problems

with maintenance and long term reliability, but they still provided an excellent platform for Ron Jarvis' rebuild. Many Exmouth Junction crews much preferred them as 'originals'. As a youngster, I asked the immortal Bill Lodge (72a's hard runner) what he thought of the A4 he had just brought in from Salisbury. "They'll goo, boy, they'll goo," said Bill, "but I tellee wot," prodding me in the chest with a large oily finger, "one of our 'Packets' would do 126 up Essendine, let alone down!"

Mr. Evans damages the worth of his reputation with his unkind and inaccurate opinions.

John Hill
Devon.

Martin Evans replies:

As Mr Hill says, I have designed a few 'free-lance' locomotives, but when doing so, I took no account as to what they would look like if scaled up to full size. In any case, if such a practice were to be followed, the model would no longer be a 'free-lance' engine!

I agree that Simplex, for instance, would look rather odd if scaled up to full-size, but what does it matter? Simplex was intended to be a simple, powerful engine, suitable for club events and relatively easy to build.

Having stated the above, I will add that I do not really care for 'free-lance' models — give me a prototype any time!

Regarding Bulleid, the reason I wrote in the way that I did was because I was becoming a little tired of hearing model engineers continually extolling Bulleid's achievements. I am aware of the good work Bulleid did when under Gresley at Doncaster; details of which will probably not be known today. The fact about Bulleid's boilers is that most of the innovations had their origins in America; however, I agree that they were fine boilers.

In summing up Bulleid's work, it must be admitted that the fact that his Pacifics had to be rebuilt means that they were a comparative failure, even though they regularly put up some fine performances. But it must not be forgotten that both the Pacifics were heavy on fuel. This was clearly shown in the Interchange Trials held by BR, when the LNER A4s were shown to be much lighter on fuel than Bulleid's Pacific locomotives.

One cannot get away from the fact that Bulleid's 'Leaders' were a complete failure and must have cost the Southern or British Railways a lot of money.

GIANTS IN THE PARK

In picturesque setting, Mt. Kenya and Mt. Killimanjaro cross the bridge over 'Dog Kennel Pond', part of the 1994 extension which took the railway closer to the house.

Mike Chrisp

provides the images to accompany words by **Bruce Whalley, Geoff Nicholson and Neil Simkins** describing events which led to an impressive display of motive power!

Many events scheduled for the early part of the summer of 2001 had to be cancelled or postponed due to widespread problems associated with the foot and mouth disease epidemic which had a devastating effect on farming and tourism throughout the UK. Our own IMLEC, due to be held at the Ashton Court track and hosted by members of Bristol SMEE, was affected, as were events planned for Weston Park Railway in Shropshire.

Bruce Whalley, Operator of Weston Park Railway kept me up to date with alterations to the programme of special events at his railway and I was delighted to be able to visit Weston Park early in the summer to witness the two East

African Railways Beyer Peacock Garratt locomotives in steam. The occasion was combined with an opportunity for other visitors to attend with their own narrow gauge locomotives for a weekend of running and good company.

My time was spent exploring the railway which is set in the beautiful surroundings of Weston Park and I took the opportunity to ride, chat, drive and prepare a photographic record of a most enjoyable outing. The information which follows is the work of those involved with events which led to the appearance of two giant 7 $\frac{1}{4}$ in gauge locomotives working together on the same railway. Bruce Whalley begins our account with a brief description of the railway, Geoff Nicholson then gives us a glimpse of the restoration work necessary to bring the two locomotives together in steam and then Neil Simkins provides us with some detailed information about the two magnificent Garratt locomotives which grace the cover of this issue. I am extremely grateful to all three for providing so much inside information and to Mick McKie by whose efforts it all came into effect.

Weston Park Railway

Bruce Whalley explained that Weston Park Railway was set up in 1980 with the removal of the Hylton Valley Railway from the home of Michael Lloyd near Bridgnorth following the latter's untimely death a short time earlier.

The Hylton Valley line was probably one of the best-known 7 $\frac{1}{4}$ in. gauge tracks in the country at the time and, after a search for new premises, Lord Bradford agreed to a line being laid in the grounds of his ancestral home near Shifnal in Shropshire so bringing Weston Park Railway into existence. The railway has continued to flourish over the last 21 years and celebrated its 21st birthday this year (2001).

With an average gradient of about 1:50 and a climb of 47ft. from one end to the other, the railway was extended in 1994 to provide a return loop taking the train closer to the house. This involved considerable earthworks and the construction of a large single span bridge over a lake.

Until two years ago, some of the original rolling stock was still operating on the railway and



Richard Coleby leaves Weston Central Station at the controls of the East African Railways Class 59 No. 5928 Mt. Kilimanjaro, built in 1975 for Brian Hollingsworth by Coleby Simkins Engineering and now resident at Weston Park. The cab view (left) reveals, clockwise from left to right, the brake pipe pressure gauge, boiler pressure gauge, injector steam valve, blower valve, steam valve for the air pump, injector steam valve steam chest pressure gauge and reversing lever.



*At the expenditure of considerable effort due to one of the power bogies being seized, Mt. Kenya was loaded onto the long trailer from Weston Park for its journey from the National Railway Museum for restoration at Weston Park by way of heavy traffic in the city of York which caused much excitement and not a little chaos!
(Photo: Geoff Nicholson)*

indeed much of the original motive power is still in private hands, although no longer at Weston. Nowadays little of the old HVR is in evidence although some of the original rail is still in place and the old coach shed from Hylton Valley forms part of the present Weston Central station.

The railway is operated as a commercial venture for visitors to the estate to enjoy, and with a length of a little under 1 1/4 miles is still the one of the longest 7 1/4in. gauge lines in the country, operating throughout the summer from Easter to mid-September.

Bruce Whalley, the present Operator, took over the running of the railway in 1998 and has been improving the operation ever since. Much of the track has been re-laid, a new electro-pneumatic semaphore signalling system installed and a signal box built, as well as the addition of a new 20ft. turntable with radial steaming bays.

Day-to-day running power is provided primarily by a new 22hp diesel locomotive built in the railway's own workshops. Steam power is provided by privately owned locomotives resident on the railway. In 1999 the railway volunteers undertook the restoration to working order of the Class 59 Beyer-Garratt built by Neil Simkins in 1977 that is now a part of the National Railway Museum's collection. By the kind permission of the Trustees of the NRM Weston Park Miniature Railway has subsequently had the locomotive on loan and it has been steamed on several occasions this year.

Current projects include the construction of a six coach, 36 seat, articulated passenger train, a coin operated LGB layout and the re-building of Weston Central Station with the addition of canopies, a new up platform, booking office and a clock tower.

On various occasions the railway holds open weekends the two main events being a Narrow Gauge Weekend and an American Weekend, these are always well supported and give visitors a chance to see some of the wealth of talent and expertise which the model engineering fraternity can produce. Visitors are generally welcome to bring suitable locomotives by prior arrangement, and these may be often seen around the railway.

Last year (2000) Weston Park Railway hosted the 7 1/4in. Gauge Society Ltd. AGM when 70 locomotives arrived with their owners and families for a weekend of running, chat and general socialising.

There are many improvements which we hope to make in the next year or two and thanks must go to the small band of volunteers without whom much of what has been done so far would not have been accomplished. On that note, we are always happy to welcome suitable volunteers prepared to help in the operation of the railway. If anyone would like to offer their services just write to us and we will get in contact. Write to Weston Park Miniature Railway, Weston Park, Weston-under-Lizard, Nr. Shifnal, Telford, Shropshire TF11 8LE; tel/fax: 01952-850336; email: info@westonrail.freemove.co.uk

The 7 1/4in. Gauge Society AGM

Geoff Nicholson takes up the story.

The small group who have been active at Weston Park Railway talked about doing something special for the AGM, something out of the usual run of things.

Some time ago, Brett Rogers acquired the East African Garratt locomotive from Brian Hollingsworth, which was in need of a complete overhaul. This we did in Brett's garage and converted it from oil firing to coal.

We asked if we could have the Lynton & Barnstaple locomotive on loan from the National Railway Museum at York. This was agreed on condition that we put it into working order. So the idea was born: could we have the Museum's Garratt, which was very much in need of restoration work? We could then have two Garratts double heading! The powers that be at the National Railway Museum agreed to let us have the locomotive for restoration to working order. On completion of the work, the locomotive could remain at Weston Park for a year and then be returned to the Museum in display condition.

We transported the locomotive to Weston Park, arriving in darkness. We managed to unload the engine onto the track leading to the engine shed which is on a curve and uphill grade. With its locked wheels, try as we might, Brett, Derek Burwell and I couldn't manage to push the locomotive into the shed. We coupled the GP40 diesel to the Garratt and pushed, but to no avail. We did manage to persuade some of the Weston Park staff to give us some help and at last managed to get the locomotive into the shed and locked up so we could go home. It had been a very long day!

Restoration work began by removing the boiler



Neil Simkins runs down the grade towards Weston Central Station at the controls of No. 5901 Mt. Kenya completed in 1979 for William Heller by Milner Engineering and now resident at the NRM, York. The cab view (right) reveals, clockwise from left to right, the brake handle, boiler pressure gauge, steam valves for the whistle, large injector, blower, atomiser and cylinder drains, atomiser pressure gauge and reversing wheel. The fire is visible through the window at the bottom of the backhead.





Above: Looking towards Weston Central Station. There are sidings behind us with a crossover to the main line. All points are operated by air.
Below: This view inside the Locomotive Shed shows plenty of space in which to work. In the right foreground is Sandy River 2-4-2 Peggy, owned by Brett Rogers and based on Maxi Lucky 7. This locomotive features in the Guinness Book of Records as having covered the greatest distance (168ml.) by a miniature steam locomotive, set at Weston Park in June 1994.



Above: Mt. Kenya's front engine with steam air pump and 'Giesl' ejector type chimney. This locomotive is presently at Weston Park by kind permission of the Trustees of the National Railway Museum at York.
Below: Bracket signals control Weston Central Station Approaches, a rising grade on the track nearer to us continues in the photograph shown above left. Between the trees can just be discerned the end of the bridge which crosses 'Dog Kennel Pool' and is shown in the heading photograph.



and then stripping off all the cladding and insulation ready for an insurance inspection and hydraulic test. It passed the inspection and tests but we discovered the shed floor covered with water on the following day. The tubes had to be removed and were found to be corroded and pitted. The Museum Trustees agreed to fund new tubes if we would fit them. Neil Simpkins took on this work while we dealt with the two engine units. This work was done in Brett's garage, one unit at a time. The wheels were removed, re-machined and given increased side play for more easy movement around the curved track. The engine units eventually returned to Weston Park and the centre frame took its place in Brett's garage ready to receive the boiler from Neil.

Reinstated on the frames, the boiler was then enveloped in ceramic fibre insulation and the lagging sheets replaced. With boiler fittings, exhaust pipe, and other associated items assembled, the centre section of the locomotive returned to Weston Park for the three parts to be combined into a complete machine. The entire rebuild was concluded just two days before the AGM and the result

met with the approval of both the Railway Museum and members of the 7¹/₄in. Gauge Society.

The EAR Garratt locomotives

Neil Simpkins writes: occasionally in the life and times of man an original piece of thinking leaps forward and gives new expression to an area of endeavour. Thus it was with Brian Hollingsworth and the 7¹/₄in. gauge.

Miniature railways handling huge commercial loads had, at their smallest, been confined to a minimum gauge of 10¹/₄in. with locomotives resembling standard gauge prototypes.

The recognition that powerful and important designs were not limited only to standard gauge raised the possibility of large powerful models being built to run on narrow tracks with sharp curves and steep gradients and furthermore, the overscale driver could be accommodated, if not in the cab, at least on the footplate.

By 1970, with two successful designs operating on 7¹/₄in. gauge (Denver & Rio Grande K36 2-8-2 and Darjeeling Railway 0-4-0) a start was made on the ultimate narrow gauge locomotive

in reality, the largest steam locomotive ever built on unit gauge, the East African Railways class 59 4-8-2+4-8-2 built by Beyer Peacock of Manchester in the 1950s, weighing in at a staggering 252 tons on a track gauge of just 1 metre.

At a scale of 1 to 5.5, the 7¹/₄in. gauge model weighs in at 1.9 tons, is nearly 20ft. long and has a 17in. diameter boiler.

The two class 59 locomotives depicted on the cover with the original builders, Richard Coleby and Neil Simpkins, have quite different histories and only came together for the first time in 2000 on the Weston Park Railway in Shropshire despite being built in 1975 and 1979 respectively.

5928 *Mount Kilimanjaro* was the first, built by Coleby and Simpkins Engineering in 1975 for Brian Hollingsworth and now in the ownership of Brett Rogers. With 10in. diameter driving wheels and four slide valve cylinders 3³/₄ x 5¹/₂in. stroke, the locomotive has a working pressure of 120lb/in². and was originally oil fired, as the prototype, but using domestic central heating oil or diesel fuel. It was the star attraction on Brian Hollingsworth's private mountain railway with



Above: Merlin, Weston Park's own diesel, awaits duty on the siding nearby Weston Central Station with Tim Carver's Cromar-White battery-electric locomotive in the foreground and the Locomotive Shed in the background.
Below: Several locomotives to the popular Romulus design were to be seen in steam during the weekend. This example is from North Wales.



Above: CP Rail GP40 James Andrew II owned by James Rogers rounds 'White Pits Pool' heading for 'Memorial Falls'.

Below: Gillian, built by T. Stirland and owned by James Rogers is seen here with Richard Coleby at the controls.



40ft radius curves and 1 in 22 gradients in North Wales. Commercial ball joints were used for the pivots and braided steel convoluted hose for the steam and exhaust pipes. This locomotive is now converted to coal firing and received automatic air brakes in place of the original (slow acting) steam brakes during its overhaul by Brett Rogers. The full size locomotives were built as dual fuel locomotives but never ran on coal in Africa. Brett has also repositioned the lubricators and added the other features which have improved the locomotive's character as a model.

After completion and handing over of 5928 on the Hylton Valley Railway in 1975, Coleby Simkins Engineering were approached by

William Heller to build a second engine to be 5901, *Mount Kenya*. This was not possible but given due blessings, the drawings and templates and some basic instructions, William Heller set about building the locomotive himself. By 1978 he was well advanced and required the boiler and tanks, together with some completion work to the power units. This was let to Milner Engineering who duly completed and painted the locomotive.

Regrettably, William Heller never took final delivery and the locomotive was put up for sale. Prior to coming into the ownership of the National Railway Museum and display in the Great Hall at York, the locomotive ran on a short-lived railway at the Crystal Palace, then passing

into the ownership of Roger Daltry of *The Who*.

In 1999, the NRM decided it was high time to give 5901 an airing and thus the locomotive was taken to the Midlands for a full boiler examination, some light repairs and for improvements to be made to the oil firing. This was all completed in 2000 and the two locomotives worked together at the Annual General Meeting of the 7¹/₄in. Gauge Society at Weston Park in the Autumn of that year.

With major developments at the planning stage for the National Railway Collection including an extension to the 7¹/₄in. gauge railway, 5901 may well be used on an everyday basis representing the long gone British locomotive builders and their great gifts to our National Heritage. 



My thanks to Brett Rogers seen here raising steam in Mt. Kenya at the beginning of the weekend's excitement, and to his team for their welcome, hospitality and invaluable assistance without which this feature could not have been prepared.



A GHOST STORY

St. BRUNO PLUG

Bob Lewis

recounts a tale with some implied and timely advice which we would all do well to follow!

It was a lovely Christmas Eve. Standing in the door of my workshop I could smell the fresh sharpness of the night blended with a hint of wood smoke from a nearby chimney. The world was at peace, a peace that flowed into the warmth of the workshop behind me, warmth blended with the friendly workshop smells of mellow oil, wood shavings and that distinctive smell of old, well-loved machinery.

My workshop is part of our garage, which is conveniently built into the house. This means the workshop has an entrance from the hallway at the foot of our stairs on one side and a door into the garage on the other. This arrangement gives plenty of air and light with the garage open, but keeps the workshop part of the home.

Building the workshop into the back end of the garage had been my first priority in retirement and I had been after a reasonably priced lathe as its centrepiece. No sooner had we laid the wooden floor when my brother-in-law Sid called from Ringwood to say that an old friend was now in poor health and, at the age of 80, wanted his beloved Boxford lathe to go to a good home. The journey from Poole to Ringwood was soon done and we trotted round from Sid's house to meet Ken.

Ken had been a fitter and turner all his life. He had worked in a factory by day and, in the early years, did out-work at home on the Boxford. His last project, in retirement, had been a beautiful 0-4-0 shunter. The Boxford appeared massive, with a huge 6in. chuck you could turn a battle-

ship on. And tools? Well there were boxes and tins and trays containing a mouth-watering array of lathe tools, cutters, boring bars and milling tools. Old Ken stood by quietly smoking his pipe, just watching the way I went about inspecting it all. I had the feeling that I was the one being inspected, to see if I could be entrusted with his life-long friend.

The smell of Ken's pipe seemed to travel with us as we brought the Boxford home. I cannot really say why, but when the Boxford had been set-up, the workshop seemed more homely, friendlier. More lived in, perhaps. I do know that on a quiet evening, sitting at my bench studying a drawing, I often felt Ken's presence. In 40 years he had adapted the machine to suit his ways, he had cut various tools for his own personal projects so, in a way, he really was there with me.

They say that one of our strongest memories is that of smell. Standing there that Christmas Eve, my thoughts drifted back over 40 years to my apprentice days in Plymouth Dockyard. Ken had been smoking St. Bruno, a rich, heavy tobacco that was also the favourite of my apprentice chum Pete Brown Cousins. The St. Bruno Pete smoked was the plug variety which produced a rich aroma and a bowl full of evil black tar!

My Aunt ran a small tobacconists shop in St. Levan road, about 100 yards from the dockyard gate and we lived above the shop. One day my Aunt gave me a display pack of Players cigarettes. The cigarettes were simply filled with filter tip material and stained to look like tobacco. At the age of 16 I had great fun offering them to the other apprentices in the training centre! I also improved my running skills after my victim's first puff!

I didn't need to run from Pete though. He took the pipe of strong tobacco from his mouth and

puffed away on the fake fag, not noticing anything wrong!

So there, that was the way my mind was running that Christmas Eve. It was time to close up for the night and even though our two sons have long since grown away I still had to stop myself from putting out a drink and mince pie for Santa.

At about 3am, I awoke slowly from a deep sleep. The air was stifling, it seemed hard to breathe, yet there was a chill in the room. I found it difficult to move, as if the blankets were tight around my legs. My heart jumped as I realised that it felt like someone was sitting on the bed.

Alarmed now, I struggled to put on the bedside light. There was no one there but the room was full of the strong smell of pipe tobacco. The smell was so strong that I knew something was very wrong. My wife and I scrambled out of bed and into dressing gowns and slippers before hurrying down to the workshop. Cautiously I eased open the workshop door. Immediately acrid fumes rushed out to greet us. There was the harsh tang of electrical arcing mixed with the choking smell of burning rubber.

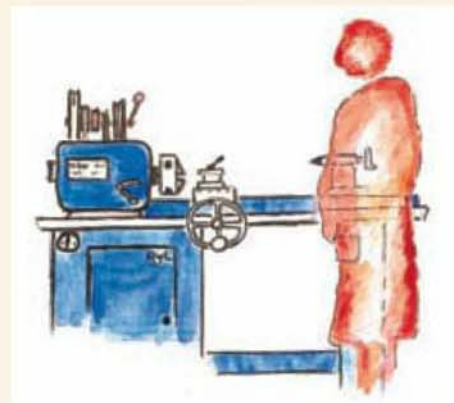
The main electricity box is in the workshop. As Joan reached for the telephone, I took a deep breath, and dove into the workshop. Throwing off the main switch, I carried on into the garage to crash open the outer door and emerge into the safety of the street.

Standing in the fresh, sweet air I realised how foolhardy I had been in protecting my treasured projects. At least I had had the sense to close the outer workshop door before going on out into the street. Shock started to set in when I realised how easy it would have been to set off a fireball.

The light of a torch showed that the 50-year-old Boxford rotary on/off switch was smoking hot. Not only the switch but also the ancient wiring running through the cabinet. Perhaps the years of faithful service had slowly put oil and metal dust into the works of the switch and it finally started to break down and burn.

In those days we did not have a smoke alarm. Had the workshop gone up in flames, the smoke and fumes coming up the stairs would have finished us as we slept. There was no doubt in my mind that Ken had saved our lives that night.

In the morning I found Ken's number and called. A lady answered. "Ken?" she said "No, there's no-one called Ken here. But wait a minute. There was a Ken before we moved in. That's right, I remember now. Nice old chap. He died though. Yes, it was just a year ago, on Christmas Eve".



MEASURING FOR EFFICIENCY DESIGN FOR A DYNAMOMETER CAR

David Tompkins

deals with the construction of the Staines vehicle, demonstrates that it suits its intended application, and considers possible improvements.

●Part II continued from page 339
(M.E. 4156, 16 November 2001)

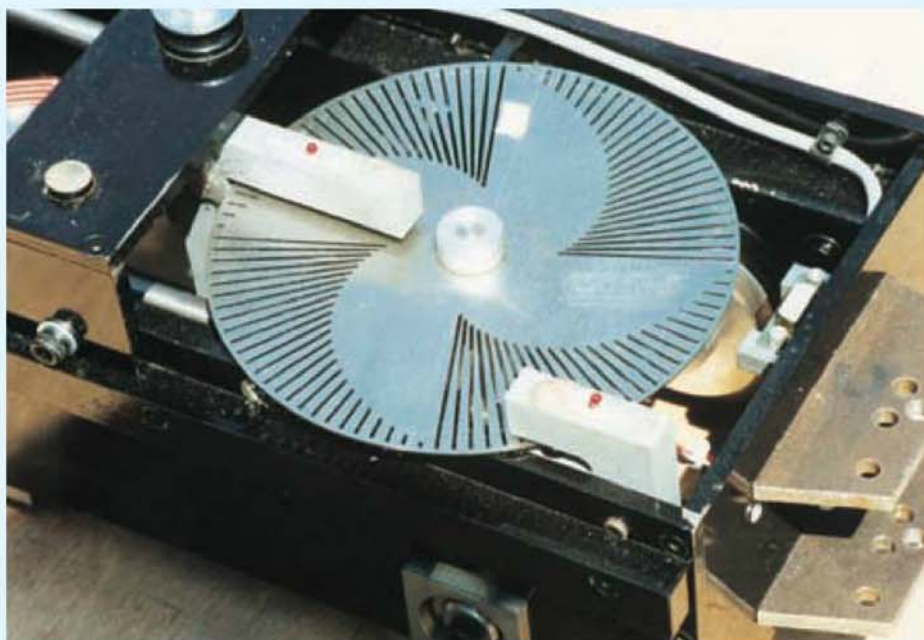
To digress slightly, some years ago I was involved in the development of a flow meter that would be able to measure mass flow, an important measurement requirement at the time for aviation fuel on aircraft. The particular device required a multiplication similar to electronic dynamometer cars. At the time however, integrated operational amplifiers were in their infancy and required lots of tweaking circuitry around their input stages. Each of the tweaks used a potentiometer like the volume control of a radio.

The kit of electronics was completed and passed to the engineer carrying out the tests on the prototype flow meter. Shortly after delivery, complaints about instability of the electronics were forthcoming. Subsequent investigation revealed that the test engineer was the owner of a small screwdriver (in those days 6d, that is 2.5p, a suitable example having been purchased from that well known tool emporium *Woolworths*). The engineer was an inveterate potentiometer 'twiddler'. All our careful setting was to no avail after the sixpenny screwdriver got to work.

Our final solution was to give this test engineer a box with access to only one control, namely, the on/off switch. Suitably admonished, the engineer achieved the results he required and we had no more complaints. After almost 30 years that same test engineer keeps the box of electronics in his office and ruefully eyes it whenever I visit him.

What has that diversionary tale got to do with Staines SME dynamometer car?

Well, the design for a club car could certainly not include analogue electronics as the potentiometer twiddle syndrome and the general lack of confidence in the stability of load cells available to the club were major factors against it.



A view of the encoder disc showing on the left the opto-sensor that is connected to the spring and draw-bar. The right-hand opto-sensor, which has a fixed position relative to the disc, counts all the slots and provides the information for distance and speed measurement. The small red bumps are LEDs which indicate opto-sensor operation. These are used to check that the opto-sensors are aligned correctly relative to the encoder disc.

A full mechanical design, using ex-bomb sight disc integrators, was considered, but in the end the quasi-disc electronics unit was designed. It has moving parts to be seen working and no analogue circuitry with their attendant problems. Only one adjustment is possible in the electronics. That is to set the speedometer scaling and this does not affect the accuracy of the fully digital 'work done' calculating electronics.

Heart of the matter

All of the calculations for the 'work done' measurement are carried out by the use of an integrating encoder. A normal slotted disc encoder works by a photo-sensor counting the slots in a disc mounted on a shaft. The number of pulses is

equivalent to the number of slots passing under the photo-sensor.

The number of shaft revolutions is equivalent to the number of pulses divided by the number of slots in the disc.

The design of our integrating encoder is different in that the slots vary in length. The general form is shown in fig 8. A total of 100 slots are equi-spaced around the disc, these slots are arranged into groups of 25. Within each group the slots reduce in length by increments of 4% from the maximum length.

Consider when the photo sensor is positioned at the outside end of the slots and the disc is rotated once. One hundred pulses would be received. If the sensor is moved halfway in, then

Figure 8: Encoder disc

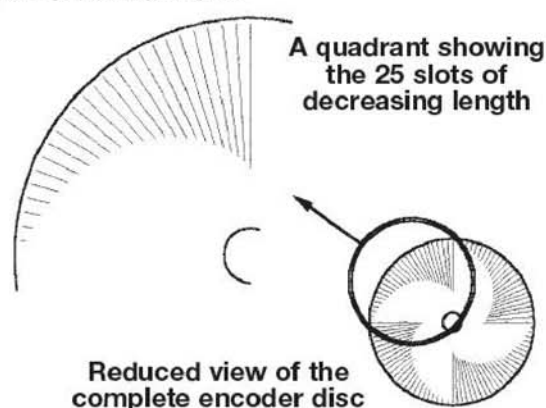
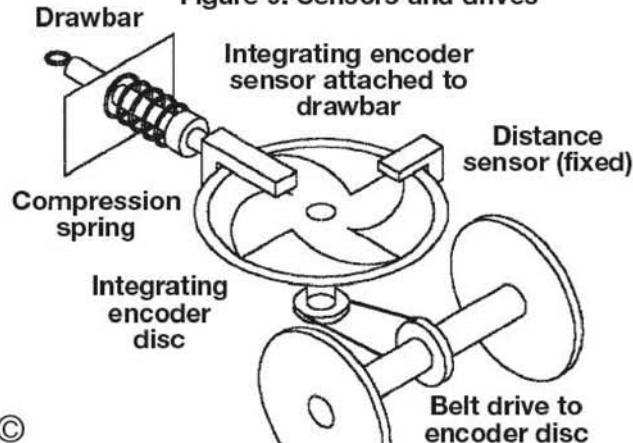
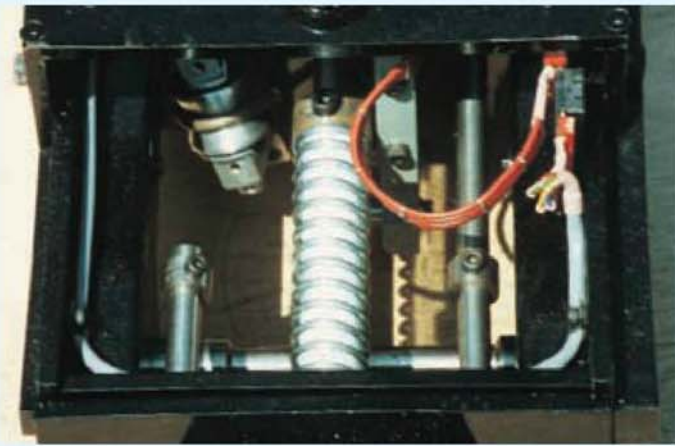
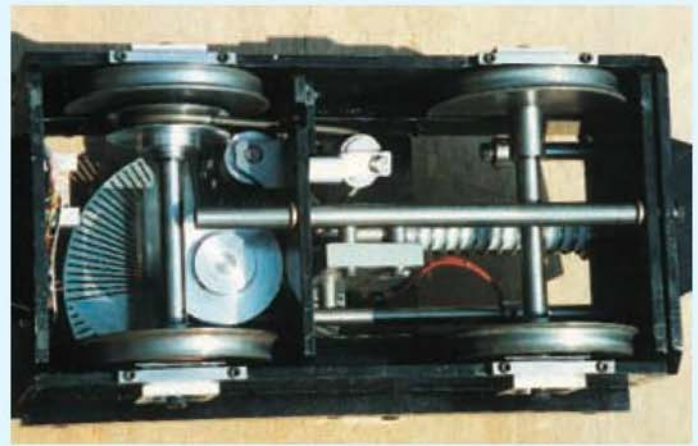


Figure 9: Sensors and drives





The spring (a 60lbf. unit) connected to the draw-bar. The spring is restrained from 'writhing' by the PTFE covered arbor through the middle of the spring. Also visible are the overload stops either side of the spring.



Underside view of the bogie. The belt drive from the pulley on the rear axle can be seen passing over guide pulleys to the pulley on the bottom of the encoder shaft.

one revolution would produce 50 pulses. Moved to just inside the longest slot one revolution would produce zero pulses. Has anyone spotted the variable gearbox effect yet?

Of course, the similarity with a disc integrator is very close. Figure 9 shows how the spring and draw bar are attached to the photo sensor along with the drive to the encoder from a wheel axle.

All we need to do now is attach a counter to the output of the photo sensor and we have a dynamometer measuring system. It works by multiplying the number of slots seen by the photo sensor each revolution by the number of revolutions of the disc.

The number of slots is directly dependent upon the draw bar pull and the number of revolutions is directly related to the distance the dynamometer travels i.e. draw bar pull (force) x distance.

But wait, if we count all the slots all the time we can measure distance travelled and, if we go back to pre-war chronometric speedometer techniques, we can indicate speed. All of these outputs are digital where the electronic signals are either there or not according to value and not some wandering value in between. No worries about potentiometer twiddling or drifts with time or temperature!

The full block diagram for the dynamometer is shown in fig 10. As you can see, the counters for work done and distance are driven directly by the photo sensors, i.e. one pulse from the sensor gives one count on the counters. No chance of tweaking by potentiometer 'twiddlers'! In practice, there are pulse shapers to ensure that the signals from the photo-sensors are nice and easy to read by the counters.

The speed indicating circuit is more complex and has a twiddle potentiometer to set the scaling of the speedometer. This works by counting the number of pulses from the 'distance' photo-sensor in a short period of time, displaying this value for a period, very quickly resetting the counter and then repeating the procedure again on a continuous basis.

The short period of time for the count is calculated as under:

For 1mph the speed counter should count 10 (the decimal point on the display is moved one digit to the left so that we can read $\frac{1}{10}$ of a mph)
 $1\text{mph} = (5280\text{ft./hr.}) / (3600\text{sec./hr.})$
 $= 1.467\text{ft./sec.}$

Now, we have arranged the design of the dynamometer such that the number of pulses received per foot is 100. So:

$1\text{mph} = 100 \times 1.467\text{pulses/sec.}$
 $= 146.7\text{ pulses/sec.}$

If we require 10 pulses for 1mph then we would need to count for a period of time:

Count time $= 10 / 146.7$
 $= 0.0682\text{sec.}$

The necessary counting time is very short. If we allow say another 0.03s to reset the counter then each speed-reading would be carried out in less than a 0.1 of a second. So, to allow the non-electronics of our brains to understand, this speed-reading is carried out only once every one to one and a half seconds. In practice, even without display blanking during the count period,

only occasionally is one aware of ghost numerals during this count up time.

Practicalities of the design

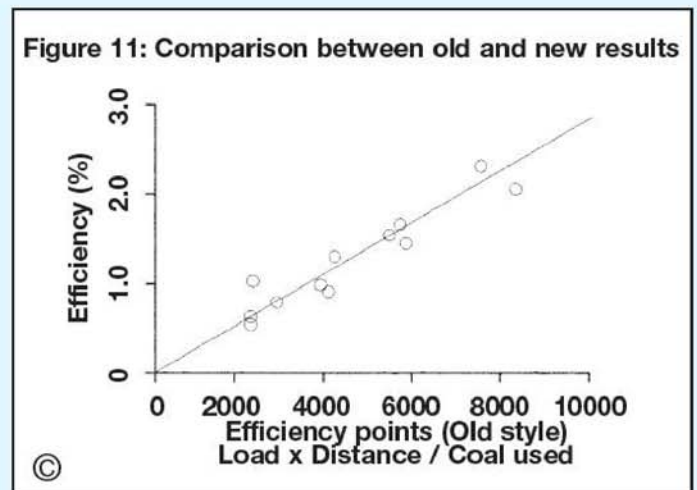
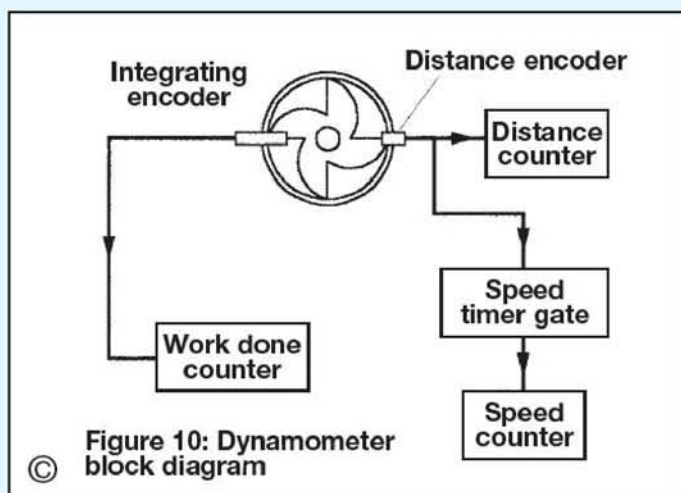
Figure 9 shows the main bones of the design. Attached to the drawbar is the work done encoder sensor. The integrating encoder disc is driven by a round belt from the rear axle geared 1:1. The drawbar is guided by slide bars and the axles are fitted with ball race bearings. Following full size practice, the suspension is provided by elastomer pads.

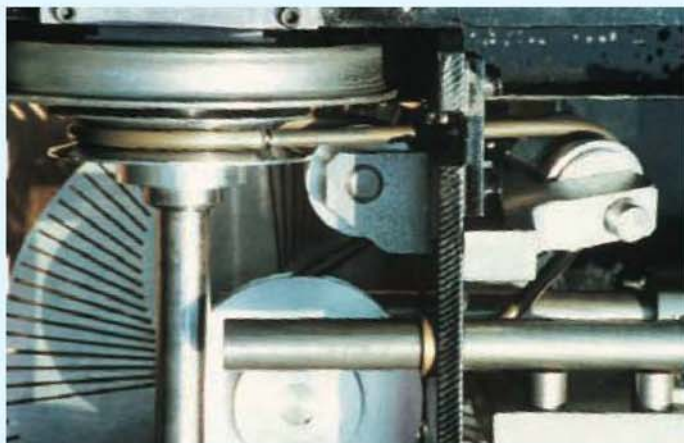
The design allows for three different springs to be used, so that the range of locomotives likely to be measured can extend from small $2\frac{1}{2}\text{in.}$ gauge models through to large 5in. gauge designs. Also to simplify scaling, the wheels are designed to have a circumference of 1ft. and the ratio of the encoder disc to wheels is 1:1.

The nominal spring maximum loads, taking commercially available springs, came out at 13.0, 24.0 and 60.0lbf. respectively. The encoder disc was designed with 100 slots.

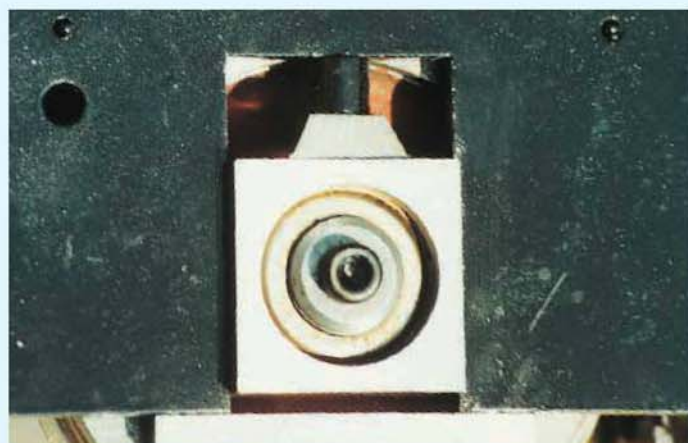
To derive the actual work done in ft.lbf. units, it is necessary to multiply the readings of the counters by scaling factors. These scaling factors will take into account such matters as the spring stiffness rate, the number of slots in the integrating encoder and the effects of machining tolerances. For the example shown below the machining tolerances are ignored as they are of small effect.

Taking the number of slots in the encoder as 100 and the maximum draw bar pull for the particular spring is 24lbf. and that the integrating encoder disc revolves once per foot travelled by the car, the scaling factors would be:





Close-up of the belt drive run. Of note is the metal double barb connector for the Roundthane belting which doesn't seem to have moved after two efficiency trials.



Each axlebox is fitted with elastomeric springing; the resulting ride seems to be adequately smooth and nothing has vibrated off. Yet ...

Number of pulses per rev. (and 1 ft.)
= 100
Draw bar pull max. = 24lbf.
Work done at max. draw bar pull:
Per rev. and 1 ft. = 1 ft. x 24lbf.
= 24ft.lbf.
Therefore work done value of one pulse
= 24ft.lbf. / 100 pulses
= 0.24ft.lbf. / pulse

This means that the reading of the work done counter has to be multiplied by 0.24 to obtain ft.lbf. work units. This factor would be 0.13 and 0.60 respectively for the other springs.

Manufacturing organisation

At the heart of the dynamometer car is the encoder disc with its 100 narrow slots; this was drawn up on AutoCAD. The drawing was sent on a floppy disc to a company specialising in laser cutting technology and two samples were cut in 1.0mm stainless steel. The cost was a short arm and half a leg but it should be possible to mill a disc on a suitable set-up.

A test rig was assembled to check the concept before a set of part drawings were produced. A treasure hunt followed with the necessary materials being 'found' and passed to various club members who carried out machining of the components. To the surprise of a number of club members the parts were fitted together in an afternoon with the minimum of bother.

The electronics along with the photo sensors were assembled and the bogie was taken to the track for preliminary tests. It was found that the distance measurement was not as good as expected. A large O-ring was being used for the encoder disc drive, and this was slipping. Replacing the O-ring with some 'Roundthane' belting cured the slip to give an accuracy within 0.6%, not bad considering the possible tolerance build-up that could have occurred.

The Club Secretary, at this point, became very enthusiastic and set the date for our club competition some five weeks later, even though the articulated seat, etc. had still to be completed.

A week before the competition the dynamometer car was completed and a trial run undertaken. The numbers appearing on the counters seemed to be in the realms of this world. Part-way through this testing, one of our members carried out a simultaneous shock test on the electronics box and battery, a pull test on the cables and demonstrated how not to try a little low flying, i.e. he fell off the dynamometer car.

A bruised knee pained the flyer (mollified by a sweet cuppa) but the dynamometer survived without damage. Checking the bogie and its articulated seat showed that the support pads at the pivot had too much clearance. Reducing this clearance has improved the stability of the ride.

The distance measurement was calibrated against a carefully measured section of the track and the springs calibrated against a spring balance. These constants enable the true work done figures to be calculated from the readings of the counters.

Before the Editor's mailbag is swelled by comments on the potential for inaccuracies in this dynamometer may I underline the fact that this was conceived as a club machine, not as the ultimate in measurement technology. The likelihood of errors caused by such factors as the friction of the drawbar slides, non-linearity of the compression springs and hysteresis of the spring material were considered to be small enough not to cloud our objective of comparative efficiency testing within the club.

Comparison of the measured work done

With the benefit of 20/20 hindsight, the idea of a bogie with an articulated seat as a driving truck was not quite right. With brakes acting only on the rear wheels of the dynamometer truck the retarding effect is limited to less than 50% of what is achieved with a normal driving truck. Also, the reach necessary for a large 5in. gauge tender engine would limit competitors to orang-utans as drivers for this type of locomotive.

Thus, the decision was taken to place the

dynamometer between the drivers' truck and the main body of the train. A correction is made for the weight of the driver and his truck in the final calculation of efficiency. (For all the purists please remember this is a club competition for some fun and not some international needle match.) This positioning of the dynamometer truck has the advantage that the invigilator does not have to worry about 'tender leaning', etc. by drivers.

Over the years Staines Society has used a formula based on (train weight x distance travelled in 30 min. ÷ coal used).

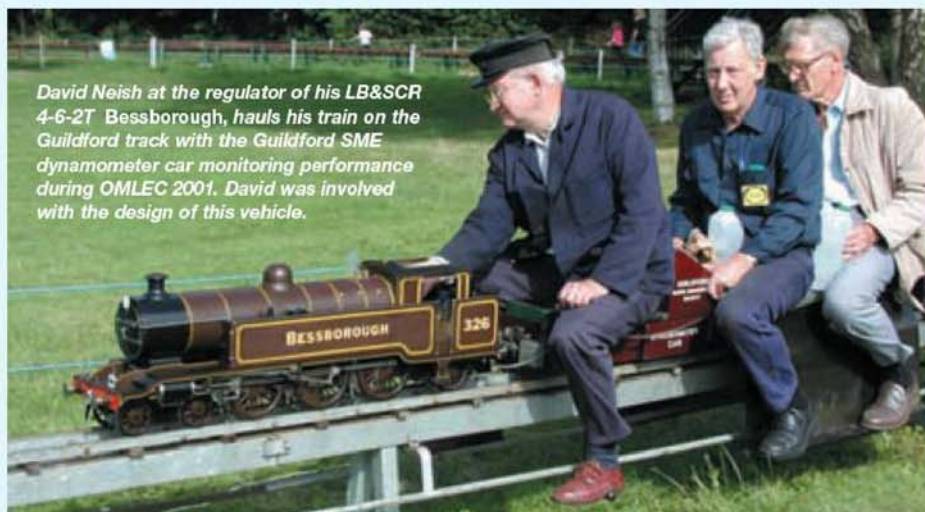
Until the reliability of the dynamometer had been checked it was decided to run the competition on the old basis in parallel with the dynamometer car. The graph in fig 11 shows the relationship achieved in our competition between the old and the new.

What next

As the old *Useless Eustace* of the cartoon strip in the *Daily Mirror* (and that dates me) said to a traveller asking directions "If I wanted to go there I wouldn't start from here." However, we are here.

Anyone starting afresh should use smaller wheels and lower the whole bogie, the effect on the number of revolutions of the encoder is not too important, the calibration factors can take care of this. The use of the digital electronics is great, no worries about stability.

The 'six foremen and one worker' effect of the club will no doubt lead to a series of modifications by committee which will give us a practical club dynamometer.



David Neish at the regulator of his LB&SCR 4-6-2T Bessborough, hauls his train on the Guildford track with the Guildford SME dynamometer car monitoring performance during OMLEC 2001. David was involved with the design of this vehicle.

BUILDING A MINIATURE UNIVERSAL LATHE

Colin Barter

describes a fascinating, versatile miniature machine tool based on a 1 $\frac{1}{4}$ x 10in. lathe which has been developing over some 40 years.

Photographs by Gerry Collins.

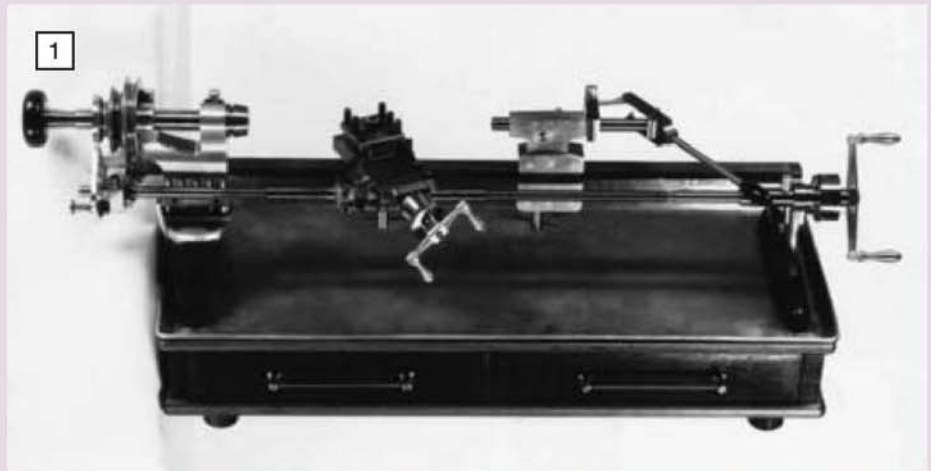
●Part I

This small machine tool originated in the 1960s as a simple small lathe concept. I had no space for a larger lathe and my requirements at that time was for a means to turn small items such as screws and parts for clocks and small models. My facilities were limited and comprised a bench with vice, the usual small hand tools, a 0-3/8in. Champion drilling machine, a good 0-1in. micrometer reading to 0.0001in. and a piece of plate glass to serve as a surface plate.

I had looked around for a small lathe such as a watchmakers lathe but had not found anything. At that time two or three small lathes were available but I thought them rather crude. In hindsight, one of these could have been suitable but it would have needed much additional work. Lack of experience at the time put me off this approach.

In reappraising my requirements I came to the conclusion that if I kept the principal dimensions small it might be practical to make a small lathe without the use of another lathe. If insurmountable difficulties were encountered then this approach could be abandoned and the resultant loss in time and materials would be minimal.

It was a challenge that was successfully completed. As it developed into the finished lathe it



The Author's original lathe is seen here mounted on the 2-drawer cabinet, date: 1964. At this time, it was equipped with the Picador pulley and the headstock thrust ballrace was yet to be fitted.

turned so well that I added collets, chucks and screw cutting facilities. By the time the lathe was completed to its finished form there were small tools and other accessories, so a two drawer cabinet base was made on which the lathe was mounted (photo 1).

Much later, towards the end of the 1980s, I thought over the practicability of fitting a compound slide rest to the little lathe within the constraints of the 1 $\frac{1}{4}$ in. centre height. As I schemed out its design I considered adding the means to engage/disengage the lead screw and a facility to carry out relief turning, or turning shapes such as hexagons. If I could add these features then, to

have a drive to the cross-slide feed screw would just be another add-on feature. In all, this was quite an interesting challenge.

At about this time, it occurred to me that an alternative accessory would be a capstan slide. This appeared practicable but would also require some interesting scheming, particularly if the compound slide rest facilities were to be included. Another challenge! Checking my collection of gearwheels for something suitable for the compound slide rest, I came across a worm and wheel suitable for a small dividing head. Yet another challenge.

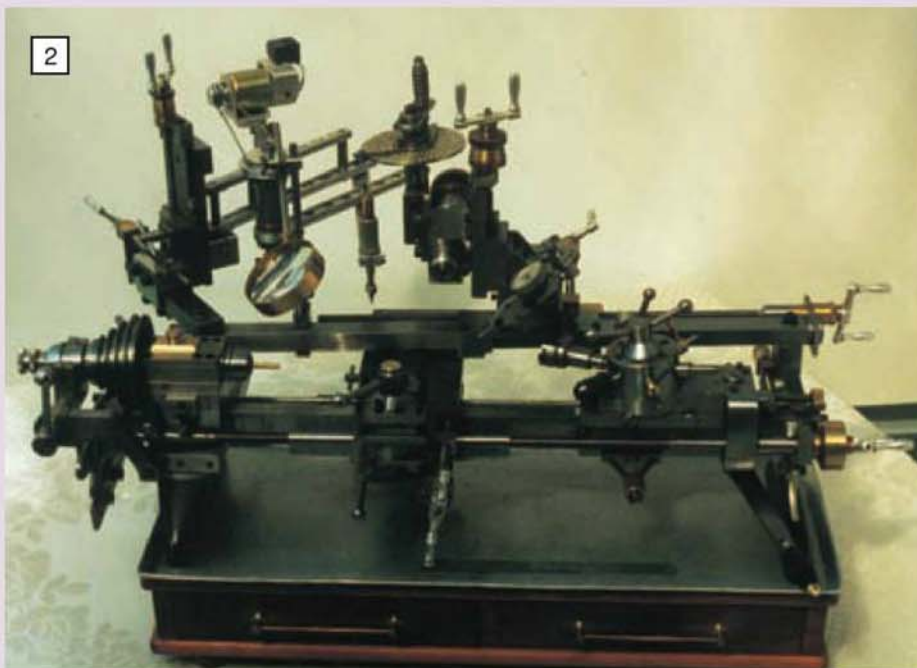
As I pursued the design of the compound slide rest and the shape turning gear, it became apparent that an extra bed with a slide would solve a problem. At the same time it would enable long tapers to be turned and also support other items; so an auxiliary bed was added. The making of the dividing head with its opposed taper bearings made me realise the inadequacy of the original headstock with its plain bearings so a new headstock was made (photo 2).

All these additions were possible because in the 1970s I had acquired a 3in. Atlas lathe and a Perfecto shaper, both second hand but little used. These were refitted because in the as-purchased condition they were incapable of accurate work.

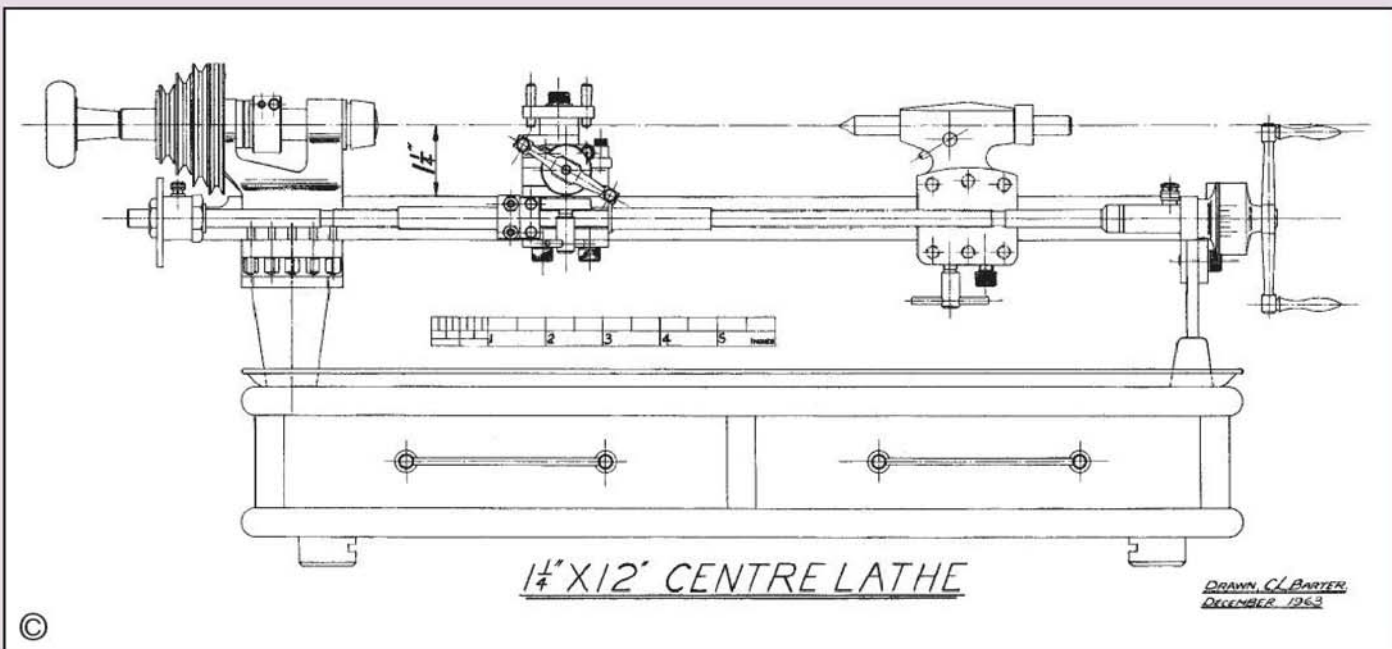
Making all these items for the little lathe resulted in a number of feed screws, all with nicely divided index dials but without figures. Stamping numbers on the index dials did not appeal to me so a little pantograph-type engraving machine was made.

By now there were so many bits and pieces that a five-drawer cabinet was constructed to hold the growing number of accessories. With further developments it now seems that a third cabinet will be required (photo 3).

I now have a very small universal lathe and sufficient parts to put a second lathe together, a useful little dividing head/ milling spindle and an engraving machine. It may be thought that such a small lathe is incapable of useful work. Within its operating envelope it performs well. I believe its



The Author's lathe with accessories mounted. These include auxiliary bed with slide, vertical slide with dividing head, second vertical slide on short bed with engraving machine, capstan head with tools fitted, collet operating gear mounted on headstock magnifying lens, and a dial indicator. (Note: this configuration is not a possible working set-up)



success is due to a simple functional design plus careful and precise workmanship.

The following articles describe the various stages of construction of a particular accessory. No difficult machining or handwork was involved, but much scheming on paper was required, with detailed layouts as necessary, together with a great deal of hand work, some of it rather tedious.

All these items and mechanisms are original concepts but incorporate details and features to be found in all sorts of mechanical devices. There is not much new, it is the way it is put together which is original, and many combinations are possible. Note also, I did not get it right every time. Perhaps these articles will prompt others to tackle a project that has stalled or has been set aside because it appears too difficult.

Original concept

In 1962, following my unsuccessful search for a small lathe, I appraised and listed my turning requirements as follows:

- Diameter of work between centres: about $\frac{3}{4}$ in.
- Diameter of work on faceplate: not more than $2\frac{1}{2}$ in.
- Length between centres: 6 to 10in. (to allow for drill and drill chuck in tailstock)
- Maximum drill size: about $\frac{1}{4}$ in. dia.
- Tool bit size: $\frac{3}{16}$ in. square
- Accuracy: Best possible
- Drive: By round leather belt $\frac{3}{16}$ in. dia. direct from $\frac{1}{4}$ hp 1450rpm electric motor using four step pulleys.

Mounting was to be suitable for holding in the vice with the motor on a hinged platform at the back of the bench. Initially the lathe would be clamped to the table of the drilling machine.

Most turned work would be in mild steel, brass or aluminium alloy. For long or thin work a fixed or travelling steady would be required.

It was quite evident that these requirements could be met by a lathe of about $1\frac{1}{2}$ in. centre height by about 8in. between centres. It would be quite a simple machine and it suddenly occurred to me that it would not be difficult to make, but could I do so without the use of another lathe? Considering the construction of the individual components and sub-assemblies I could see no great difficulties except for the boring of the headstock and tailstock, and making the headstock mandrel.

After a good deal of thought and sketching to eliminate unnecessary work, I concluded that a lathe with a bar bed, a simple saddle with a single tool slide which could be set at an angle, and a feed screw to traverse the saddle along the bed would cover my requirements for turned work. The headstock would have simple plain bearings with a saw cut and adjusting screws for setting the bearing clearance. Owing to the small centre height, the driving pulley would be overhung at the outer end of the headstock. The headstock

would be free to be located anywhere along the bed. It was foreseen that if the lathe was self-built this could be an advantage.

The tailstock would be quite simple with centres or runners from silver-steel rod. They could be pushed into place and changed to suit the work. If the construction of the lathe was successful, something more sophisticated like a lever fed arrangement could be added. Except for the use of standard screws, taps and dies, no other screw threads were practicable for major items such as the headstock mandrel. For feed screws I proposed to use screwed studding; $\frac{1}{4}$ in. Whitworth with its 20 threads per inch was a suitable diameter and later, if it was worth adding, graduated dials would enable the depth of cut to be indexed.

The saddle, tool slide, and tool holder could be fabricated from flat plate riveted together. A square or rectangular bar bed seemed to be the simplest means of keeping the headstock, saddle and tailstock in alignment and was the option involving the least work.



The lathe in its present form mounted on the original 2-drawer cabinet with integral drip tray. Underneath is the 5-drawer storage cabinet with two drawers open to show stored accessories. Note the dividing head mounted on the headstock.

1 1/4 x 10in. UNIVERSAL LATHE
Figs 1 & 2 - SADDLE AND SLIDE CONSTRUCTION

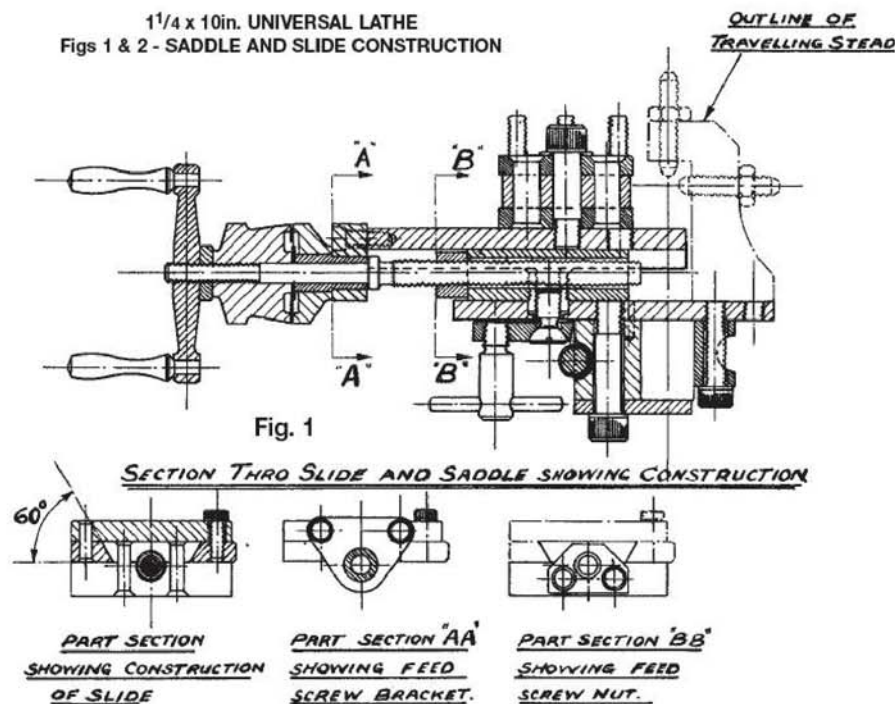


Fig. 2

Materials and construction

Searching for materials I decided that gauge plate was ideal for the bed, saddle and slide. It could be obtained in a wide range of sizes and was ground all over. Furthermore, it came in 18in. lengths. A 1/2 x 3/4in. section was available for the bed and, although I would have preferred a bar about 3/4in. square, it would serve. If it proved inadequate I was confident that a solution could be found. The 18in. length of the bed was attractive as it freed the design of limitations on bed length and pieces could be cut off for constructing the saddle.

Having decided on the bed size I sketched out the saddle and tool slide. The saddle was quite simple and I could see no problems. The tool slide would require careful filing plus riveting with careful fitting for it to be successful. I decided to conceal the feed screw within the slide base to keep it clear of swarf. The saddle top plate would be in 3/16in. plate, the slide base in 3/16 and 5/16in. plate, and the slide of two pieces of 3/16in. plate. Totalling all the thickness dimensions of the plate and including the tool holder and tool, I obtained a figure of 1 1/4in. which would be the centre height of the lathe.

Although I thought this could be somewhat small, it would meet my stated requirements. With such a small centre height the 1/2 x 3/4in. bar bed did not look out of proportion. The lathe would not be difficult to make as the amount of material and the area of surfaces to be filed and finished would be small and not much would be thrown away if it turned out to be a dud idea!

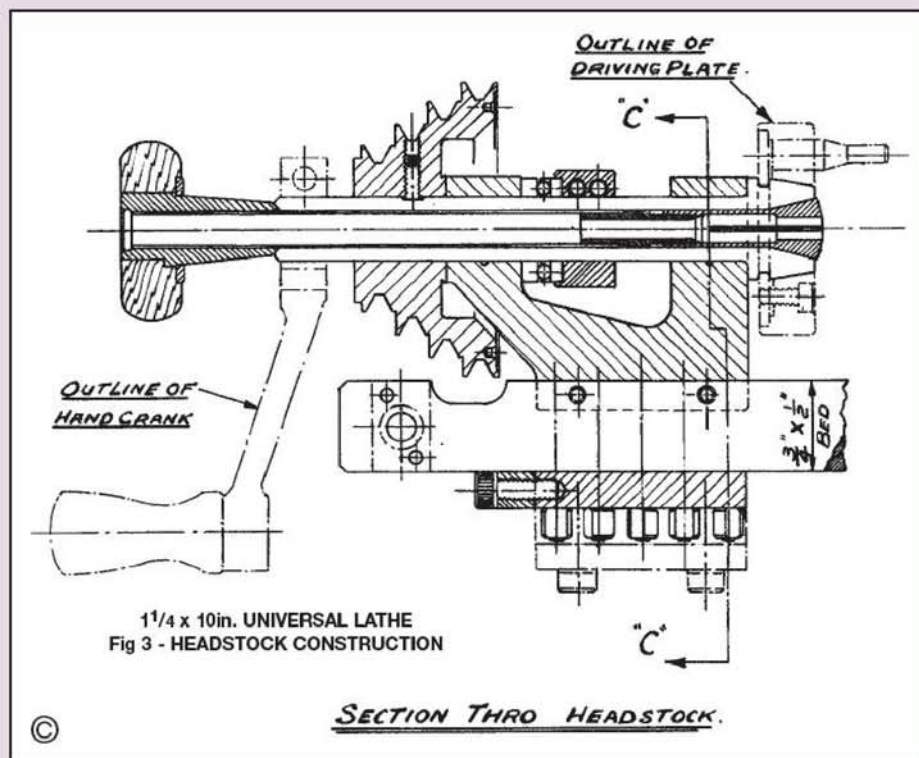
Making the saddle presented no problems; instead of using pieces of the bar bed to form the box enclosing the bed, I used pieces of light alloy as this was easier to cut and file to shape. The slide was more difficult as it required a great deal of careful filing and scraping to ensure exact fitting of the slideway vees. If the lathe was to be successful, the fit of the sliding parts must be as near perfect as I could achieve.

with a silver-steel mandrel. It simplified the bearing problem as the mandrel could be run directly in contact with the alloy. Having accepted aluminium alloy for the headstock I considered its use for the tailstock. I was somewhat dubious about using this material but it was certainly easier to work than mild steel. Weighing up the advantages and disadvantages I went ahead with the aluminium alloy.

A 1in. thick slice was cut from the aluminium alloy block, the outline of the headstock marked on it and the surplus metal cut away by drilling and sawing. The slot in the base of the headstock was chiselled out and finished by filing, final fitting being achieved by the use of fitter's blue and scraping. The outer shape was filed roughly to its finished form and left until the bearing holes were bored. A clamp plate and 10 securing studs were made to hold the headstock firmly to the bed. The reason that 10 studs (5 each side) were used was that by the time the sides of the headstock had been filed it was just over 0.9in. thick. There was only a thickness of 0.2in. of metal in the foot each side of the bed bar and to be certain of adequate strength, 10 small diameter studs were used (Fig 3).

The tailstock was fabricated from 1/2in. thick aluminium alloy plate plus pieces of 5/32in. thick steel plate to form the box enclosing the bed. These were initially bolted together and filed as necessary to achieve a close fit on the bed. Before final riveting together, the bottom block was drilled, tapped and recessed for the clamping screws, springs and pads. The final adjustment to the bed was made after riveting. The outer shape was filed roughly to shape and left until the bored holes for the tailstock runners were completed. Holes were then carefully drilled at the centre height ready for boring the headstock and tailstock to their finished sizes.

●To be continued.



1 1/4 x 10in. UNIVERSAL LATHE
Fig 3 - HEADSTOCK CONSTRUCTION

SECTION THRO HEADSTOCK.

LETTERS TO A GRANDSON

M. J. H. Ellis

returns to the problems of tapping and some helpful advice before discussing the machining of a milling spindle head casting.

●Part XXXIV continued from page 333 (M.E. 4156, 16 November 2001)

Dear Adrian, in my last letter I expatiated on the subject of tapping-size drills and the advantages of using a size somewhat bigger than the core diameter of the thread. By the way, as regards the job which I mentioned, which required 4BA holes to be tapped in stainless steel plate, I had another go at it using the BSI recommended drill, and this time I managed to tap all six holes successfully, although care was still necessary.

You will remember that I surmised that someone might have carried out research on the subject. This was a reasonable enough supposition, as the short articles contained in publications like *Fowler's Mechanics and Machinists' Pocket Book* are full of references to experimental work. I have this very book by me as I write, and taking an example at random, I find:

"Ratio of Power to Weight of Metal Cut. Professor Flather made experiments with lathes of various sizes and at various speeds." He found that to remove metal at the same rate as a lathe, a milling machine required approximately six to seven times more power. Elsewhere I found another interesting snippet:

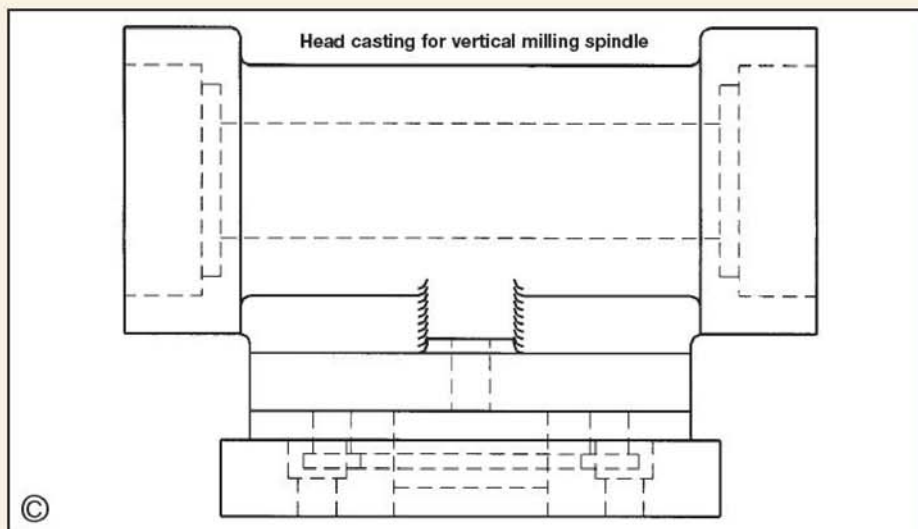
"For cutting threads. After trying various kinds of lubricants in cutting threads on tool steel, machine steel, etc., a writer in Machinery has found common lard (not lard-oil) mixed with about 1/3 turpentine have the best results."

These 'Pocket Books' are so packed with useful information that if ever you see one in a second-hand book shop, I advise you to snap it up. In fact, they are not expensive; the one I am looking at cost only 2s.6d. (20 cents) when it was new, although that was in 1941.

However, I am wandering from the subject again. It is this: after I wrote the letter to you, I wrote another to the Institution of Mechanical Engineers, asking if they knew of any experimental work on the subject of tapping drill sizes. I was pleasantly surprised to receive a most gracious reply from no less a person than the Director General, Sir Michael Moore. Here is a summary of what he said:

"The question of the relative sizes of tapping drills and screw thread holes is an interesting one. The answer appears to lie in the needs of industry rather than in particular pieces of experimental work."

"I quote from Ian Bradley and Norman Hadley's book Screw threads and twist drills. 'The diameter of the hole drilled for tapping was formerly but little larger than the theoretical core diameter of the male thread, but this practice has now been largely superseded, and a hole with a greater tapping clearance is more generally used. This is in part the outcome of production methods where it is essential to reduce tap breakage



and wear, and to increase output by speeding up tapping operations.

"However, even in the small workshop, the use of a larger size tapping drill allows the hand tap to align itself more readily with the axis of the hole, and at the same time the reduced turning effort required helps to preserve the tap from breakage."

"You would be most welcome to use the Institution's extensive library for your research."

That courteous reply, by the way, bears witness to another piece of advice for you: you will never give offence by asking someone for advice.

I will round off this topic by observing that when you have the job of tapping a hole in a difficult material, it is helpful to set about it with patience, starting with the taper tap, and going as far as you can, then changing to the 'second', and seeing how far you can go with that, and finally, you may be able to go a bit further with the 'plug' before repeating the cycle with the taper tap again. In the case of the difficult job which I mentioned, I went round the cycle three times on each hole, and the material was only 5/32in. thick.

What I intended to be no more than an *hors d'oeuvre* has extended to half the length of my letter, and I must press on with the main course. I have emphasised already the need to plan the sequence of operations on a piece of work, and I can think of no better object lesson than machining the casting for the head of the vertical milling attachment which I made for the Astra horizontal mill. The spindle runs on taper roller bearings. Ball bearings would have done the job, but I used taper rollers partly because they are more robust, but mainly, because they take up less room. I won't go into the production of the spindle, because it followed very similar lines to those which I have already described for a lathe mandrel. I worked throughout on the assumption that I ought to take particular care to ensure that the housings for the two races were truly co-axial. I had already machined the pad-like casting onto which the head is secured by two T-bolts. The heads fit into a circular T-slot, so allowing the head a degree of tilt, to the extent allowed by the V-belt drive. Machining the pad was no problem.

The sequence of operations on the head was as

outlined in the following notes:

1: I began by turning the boss and spigot on the side of the head, which fit into the pad, which in turn bolts onto the end of the girder-type overarm. Then I drilled the holes for the bolts, and faced off the seating for the nuts.

2: Before I could proceed further, I had to make a large 'inside' angle plate, which was the only way of mounting the casting in the lathe for boring it through and turning the bearing housings. I bolted the head onto its pad, the way it would go together later when in use, and set it up on the angle-plate, the latter bolted on the faceplate. I faced-the end of the casting, bored it right through parallel, about 3/16in. bigger than the spindle, and very gingerly bored out the housing for the outer bearing race an easy press fit. I should mention that I had sufficient forethought to remember that I might one day wish to withdraw a race, and I therefore recessed the inner wall of the housings to within 1/8in. of the bore, so that I would be able to pull the race out by means of a hooked tool. I set up the casting as I did in order to ensure that when in use, the spindle would be parallel to the vertical ways of the machine to the degree of accuracy to which I had made the angle-plate.

3: The next operation required the casting to be turned around on the angle-plate so that it could be machined at the other end. To get it square I kept the machined end tight against the face-plate with a parallel bar interposed over the top of the angle-plate. By tapping it from side to side I got it running true to within around 0.005 inch. In theory, I should have been able to do better than this, and so far as I can see, the residual error must have been because the angle-plate was a little out of square. All the same, the webs were nearly 5in. wide, so the out-of-square only amounted to 0.0005in. in the inch, and I don't think that I could have hoped to do any better, just using an ordinary engineer's square.

I was not content with the thought of having the housings out-of-line to that extent, and so I had to alter my original plans in a way which it would take too long to explain in this present letter, but which will feature in the next. Wait for it!

Your affectionate Grandpa.

●To be continued.



SENTINEL 'S'-TYPE WAGGON in 3in. scale

John Haining

discusses the valve events for the Sentinel SD4 engine and gives some thought to the camshafts.

●Part VII continued from page 595
(M.E. 4148, 15 June 2001)

The Sentinel S-type engine has a camshaft each side of the cylinder castings, one for steam and the other for exhaust. Both camshafts are driven by a gear train at the front of the engine and run at crankshaft speed. The selector mechanism and arms are housed at the other end, the arm pivoted on top of the housing controlling the sliding camshafts, and the one mounted below moving a sliding gear transmitting the drive to the output shaft and thence to the hind axle.

Each camshaft has a series of five cams, marked A, B, C, D and E on the works drawing, and giving a series of cam contours on a controlled sequence offering Forward Start, Forward Slow, Forward Fast, Drain and Reverse. These are obtained by sliding both camshafts along horizontally, operated by a lever in the driving cab and linkage to the lever on top of the cast housing. The cams are designed to permit smooth movement of the cam faces below the roller ends of the valve tappets as the shaft slides along to give the selected valve openings, the only sound betraying the movement being an occasional slight 'click'.

On the 3in. scale version of the engine for the S-type waggon, it is planned to follow the same layout, sliding both camshafts along horizontally to bring each of the five cams into operation as required. If the full sequence of five cams is to be reproduced as in full-size, we have a choice of machining each cam individually and then reaming it to a light press fit on the shaft with a grub screw through each cam (opposite to the face side) to secure it on the shaft once its angular position is confirmed as correct. Each camshaft machined from the solid gives absolutely no scope for adjusting the valve events individually as required, and I dislike the idea of having non-adjustable valve timing!

I think that this problem is one that will have to be resolved by consultation with readers who intend to have a go at making this model and who will undoubtedly be more skilled and better equipped than I am, for machining their two camshafts. The full-size camshafts are 3ft. 8 1/4in. length by 2 1/4in. dia. at each end and in the middle, where it is also supported in a bearing.

Cam contours for both inlet and exhaust are identical, the variations being in the angular setting of each one, of course.

The camshafts for the 3in.

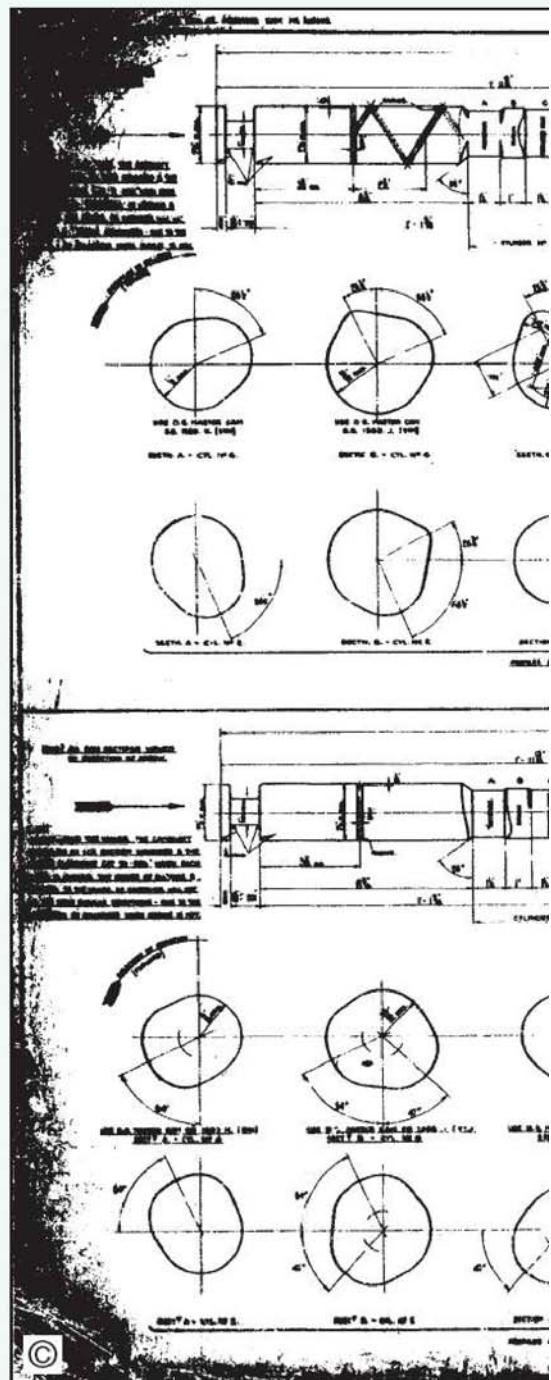
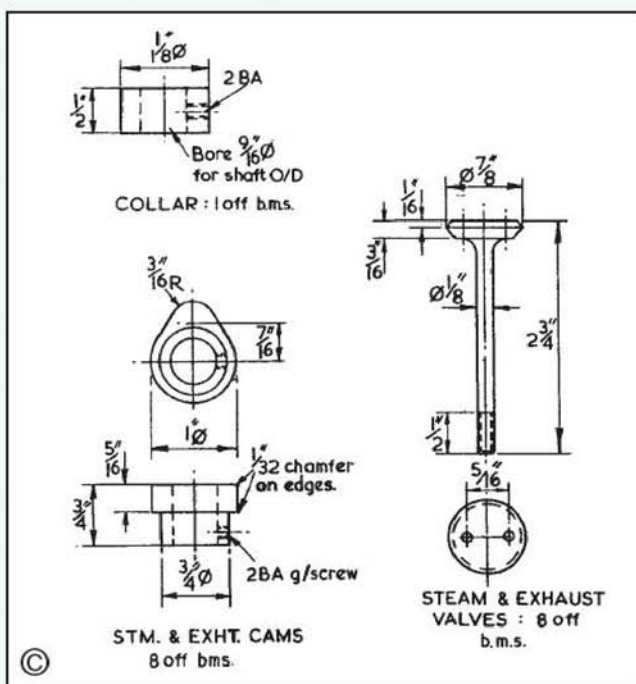
scale version of the engine are 10 3/4in. length machined from bright mild steel bar 1 1/16in. dia., this diameter being retained at both ends and the middle section, which run in brass bushes pressed into the crankcase.

I hesitate to publish a drawing of the finished camshafts until I am satisfied with the cam profiles and sliding action in the end bearings. Work is in progress now and will be ready for publication shortly. I always found it easier to draw out the sliding movements of the S-type Sentinel camshafts to illustrate their working than to try and explain them to people used to a camshaft firmly retained laterally within its bearings. When I have finished experimenting with the cam layout on my four-cylinder engine I will decide on which one to include for readers of my M.E. articles.

In deciding to construct a four-cylinder engine in 3in. scale loosely based on the highly thought of and much admired four-cylinder S-type waggon engine produced by Sentinel at Shrewsbury for the very last range of steam waggons to leave their works, I let myself in for quite a lot of work. The preparation of drawings suitable for supporting a series of articles in *Model Engineer* is in itself a very time-consuming task and writing on the subject can be equally so. I dislike writing on the construction of a completely new model unless various difficult or unusual sub-assemblies or components of the model have actually been made. I am sure that readers will understand the position and will be prepared to wait until an engine is at least some way towards assembly before expecting to see results in these pages.

The method of using the twin camshafts in a sliding mode to obtain both cut-off variation and reversing facilities is neat and self-contained, but

it does present a few problems. The alternative method of obtaining a reverse mode by means of a small gearbox attached to the engine has a certain attraction and will have to be considered as a viable alternative. Recalling my days at Sentinel, I remember the American designer Abner Dobie, who was a consultant to the firm at one time, being credited with a dislike of Stephenson's valve gear so frequently used in British designs,



but rarely on Doble's engines, and never on Sentinel undertypes.

I include a print of Sentinel's twin camshaft layout with a contour of each cam under the headings 'Start', 'Slow', 'Fast', 'Drain', (all open) and 'Reverse'. This gives a total of 40 cam contours, 20 on each camshaft, at which my mind boggles, together with five positions each. I am working on reducing the number of cams to a more workable total, or at least one slightly less tedious to cope with; but this, I'm afraid, will not be ready for a while!

I also include here a simple camshaft layout of two shafts plus four cams each, one camshaft for steam and the other for exhaust. This is intended as a simple alternative to the one described

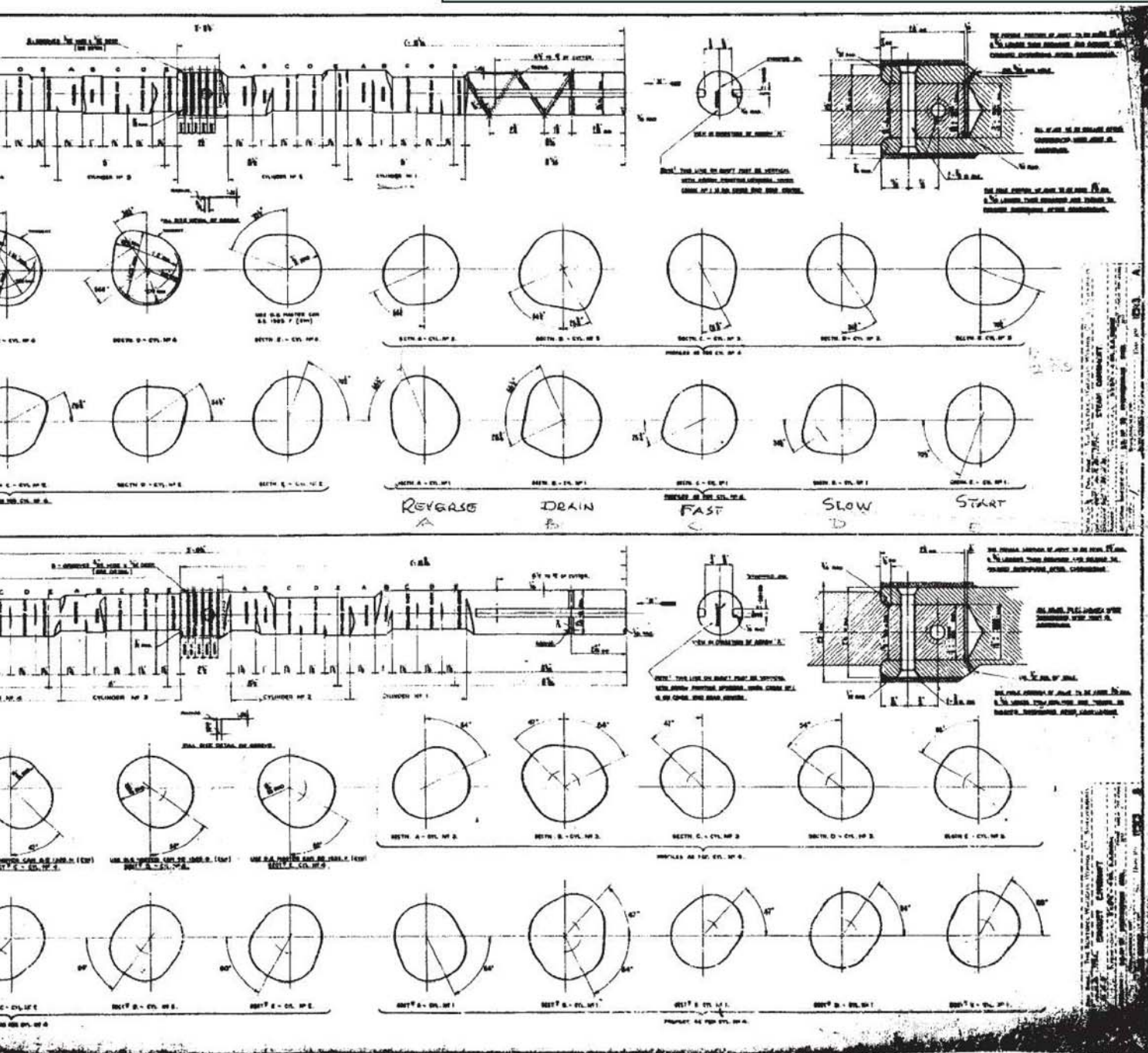
Sentinel SD4 No. 8448 Valve events

	Cut Off 80%	60%	30%
Cylinder 1	Forward Start	Slow	Forward Fast
Steam opens	16deg. BTC	16deg. BTC	16deg. BTC
Steam closes	132deg. ATC	86deg. ATC	74deg. ATC
Exhaust opens	26deg. BBC	26deg. BBC	26deg. BBC
Exhaust closes	30deg. BTC	30deg. BTC	54deg. BTC
Cylinder 4	Forward Start	Slow	Forward Fast
Steam opens	Top centre	14deg. BTC	16deg. BTC
Steam closes	148deg. ATC	92deg. ATC	82deg. ATC
Exhaust opens	28deg. BBC	30deg. BBC	30deg. BBC
Exhaust closes	22deg. BTC	32deg. BTC	44deg. BTC

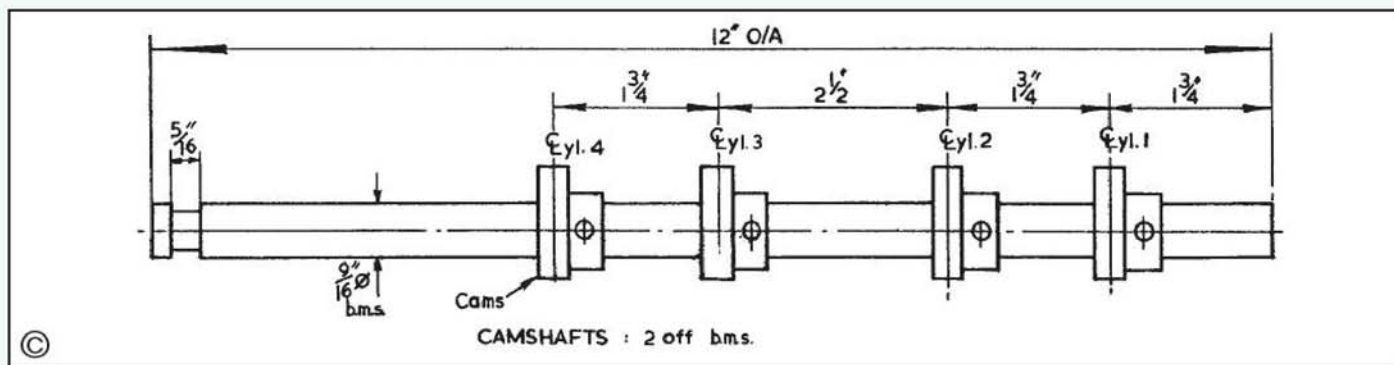
Notes: Events timed when lash is taken up.

Full open to full closed = 15deg. approx crankshaft movement.

As engine is horizontal, 'Top centre' = outer centre; 'Bottom centre' = inner centre.



In the hope that readers will excuse the poor quality of this drawing prepared from a difficult original we trust it will still be of interest.



above, but gives less scope for fine cam setting.

Mention of Abner Doble's reluctance to get involved with cams and camshafts reminds me of the famous W. O. Bentley who designed the original *real* Bentleys. Bentley served his apprenticeship at one of the great railway locomotive works and, probably as a result, showed a great disposition to drive the overhead camshafts of several of his cars by means of eccentrics and eccentric rods, and very successfully, too.

On this engine, one spur gear on the crankshaft

drives a larger gear above it which in turn drives each of the two camshafts, one each side of the cylinder casting, at crankshaft speed. The gears are listed below:

- 1 off crankshaft gear:
1in. PCD, 1.100in. O/D, 20 teeth.
- 2 off camshaft gears:
1in. PCD, 1.100in. O/D, 20 teeth.
- 1 off intermediate gear:
2in. PCD, 2.100in. O/D, 40 teeth.

The gears are bored to suit the camshafts and

crankshaft and are keyed to shafts. They are supplied by S. H. Muffett, Ltd., 14-18 Woodbury Park Road, Tunbridge Wells, Kent TN4 9NH; tel: 01892-542111. They are listed on page 18 of their catalogue and are supplied in steel or cast iron.

One of my Sentinel owning friends, who will be duly acknowledged in the end papers of this series, has sent me a copy of his record of valve events on SD4 No. 8448, and I include this for readers who like to ponder on such things.

●To be continued.



Visit Sinsheim with Glajd UK and SM&E

Glajd UK, the experts in special interest holidays, announce their latest tour from 10 to 14 January 2002, designed for all model engineering enthusiasts.

Whether your interest in model engineering is avid or obsessive, Glajd UK's Model Engineering Exhibition tour will suit everyone. For really dedicated enthusiasts, three full days can be spent at the fascinating exhibition; for those who prefer a little variety on their outings, other day trips are planned. A tour of the river Rhine and a trip down to Mulhouse in France will offer fantastic sightseeing opportu-

nities with a chance to visit either the French National Railway Museum or the National Automobile (Schlumpf) Collection which houses over 120 Bugatti cars.

The Model Engineering Exhibition in Sinsheim is hailed as the largest indoor steam exhibition anywhere in the world and houses 6000 metres of 5in. and 7 1/4in. gauge track together with smaller gauges, boat pool, road vehicles, stationary engines and many trade stands.

The Glajd UK Model Engineering Exhibition Tour is organised in conjunction with The Society of Model and Experimental Engineers. Details of the full itinerary and a tour booking form can be obtained from Glajd UK, PO Box 1829, Shrewton, Salisbury, Wiltshire SP3 4PN; tel: 01980-621900; fax 01980-621418; email: linda.hardiman@glajd.co.uk



Christmas cards from the Welshpool & Llanfair Light Railway

The Welshpool & Llanfair Light Railway is offering exclusive Christmas cards for Christmas 2001 depicting a wintry scene on the railway. The sample shown above is a nostalgic artist's view of 0-6-0T GWR No. 823 *Countess* passing Seven Stars halt in Welshpool with a mixed train in the 1930s.

Prices are: 5 cards £1.85; 10 cards £2.95; 30 cards £7.95, any mixture, all post-free. Please make cheques payable to W&L Sales Ltd. The cards are available from R. E. Cartwright, Owl Halt, Manor Road, Sealand, Deeside, North Wales, CH5 2SB; tel: 01244-815273.

Tap & die set from Tracy Tools

The special offer from Tracy Tools this Christmas is a model engineer's 26 piece tap and die set supplied complete with holders and housed in a wooden box as shown in the

accompanying photograph.

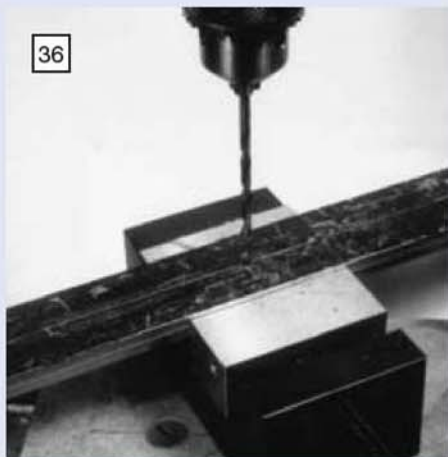
The set is available for a VAT inclusive price of £38.00 + £4.00 postage and packing (UK) from Tracy Tools Ltd., 2 Mayors Avenue, Dartmouth, South Devon TQ6 9NF; tel: 01803-833134; fax: 01803-834588; Credit Card Hotline: 01803-839500.

London Festival of Railway Modelling at Alexandra Palace

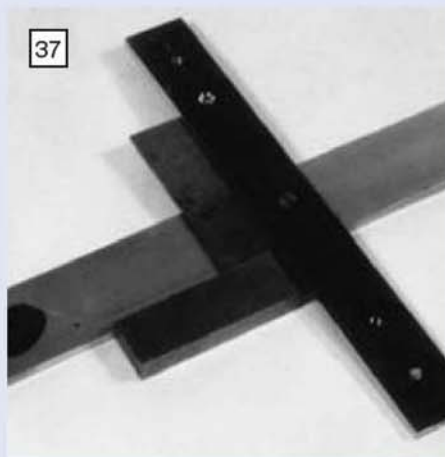
Now in its 3rd year, London's newest event for railway modellers is presented by the publishers of *British Railway Modelling* in association with the Model Railway Club over the weekend 23/24 March 2002.

Discounted tickets may be pre-booked from *British Railway Modelling* Exhibitions Department, Warners Group Publications plc, West Street, Bourne, Lincolnshire PE10 9PH; tel: 01778-391156 or 01778-391105; fax: 01778-394748; www.brmodelling.com

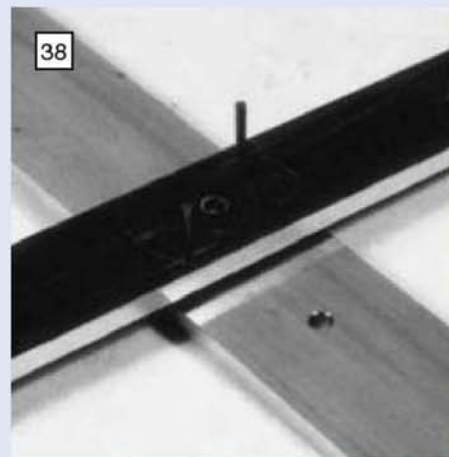




Drilling the No. 36 size hole in the plates.



Aligning the cross strut using an engineer's square.



Drilling the holes for the steady pins.

John Wilding FBHI

continues the construction of his elegant egg timer with the cross strut and other frame components.

●Part IV continued from page 388
(M.E. 4157, 30 November 2001)

The cross strut is dimensioned on the drawing fig 27 (see M.E. 4157, 30 November 2001). As can be seen from the general arrangement drawing, it is situated on the back plate $7/8$ in. above the lower plate pillar, where it is secured by a single 5BA screw. To prevent twisting, it is positively located by two steady pins. The two dial pillars and spurs are fitted at the extremities of the strut.

The 6in. length of brass strip is marked out according to the drawing and the central $1/8$ in. clearance hole drilled. The main plates should be registered together and the No. 36 hole drilled through both together, photo 36. They are then separated and each hole tapped 5BA. The cross strut is now fitted to the back plate with a 5BA screw and set at right angles using the engineer's square as demonstrated in photo 37. With the screw securely tightened, the assembly is taken to the drilling machine and the steady pin holes are drilled right through both components with the No. 55 drill, photo 38.

The procedure for fitting the steady pins is identical to that already described when fitting these in Part II (see M.E. 4156, 16 November 2001). A stage in the work is shown in photo 39 where the strut is shown prior to broaching the lower holes in order to enable the two components to fit together. It will be noticed that there is a $1/8$ in. hole which is shown countersunk on the left side of the strut. This is for a weight hook. It is countersunk on both sides and I show the operation being carried out with a homemade countersinking tool in photo 40. The drill should be run at the slowest speed in this situation owing to the large surface area of the cutting tool in contact with the work.

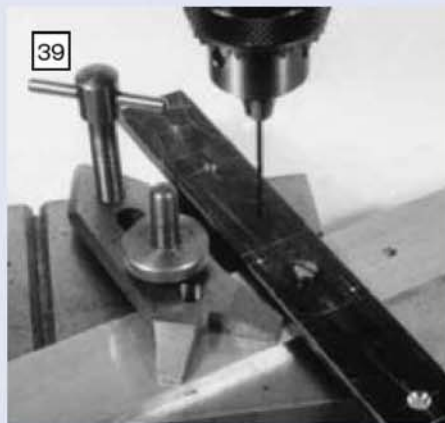
Unlike the register pins which will eventually be knocked out and the holes plugged, these steady pins are permanently fitted and should therefore be filed flush with the front face of the strut. As I mentioned earlier, a piece of waste camera film is useful in this situation. It is placed over the cut off portion of the pin and, after the first few strokes with the file, the pin will show through the film as can be seen in photo 41. After the pin has been brought down to the level

of the film this can be removed and the work made flush with the surface of the strut using a stick of Water-of-Ayr stone. This fine stone is used with water and will not scratch the brass.

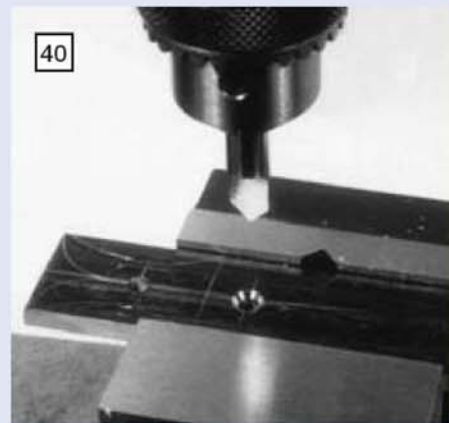
Dial pillars

These are dimensioned on the same drawing and the machining procedure is similar to that on the plate pillars. Again, a centre drill is used to provide a start for the No. 50 drill which will be followed by the 8BA tap at one end. The other end is

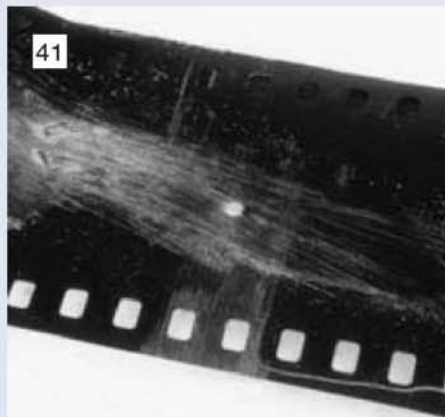
turned to $1/8$ in. diameter and threaded 5BA. To ensure that the die is presented truly to the work it is desirable to carry out this operation in the lathe using a tailstock dieholder. This is not available in the range of Unimat accessories, however it is one of the projects in the book by Gerald Wingrove listed in Part I of this series. I have also described its construction (ref 1). The set-up is illustrated in photo 42. Although I state that the extension to the dial pillar is turned to $1/8$ in. diameter, it is usual to make it a little smaller



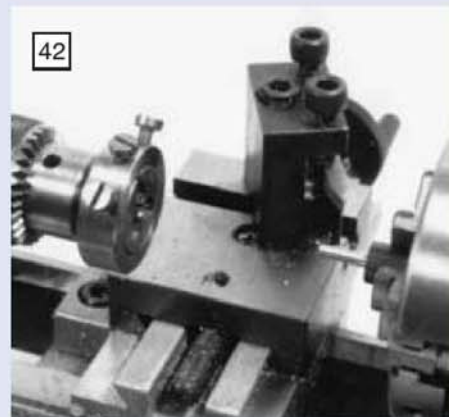
The holes in the plate now need broaching out.



Using a homemade countersink drill.

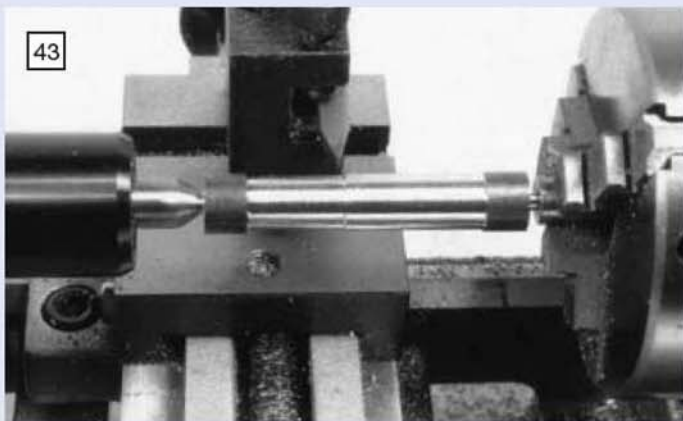


Protecting the plate when filing steady pins flush.



Using a homemade dieholder in the Unimat 4.

WEIGHT DRIVEN EGG TIMER



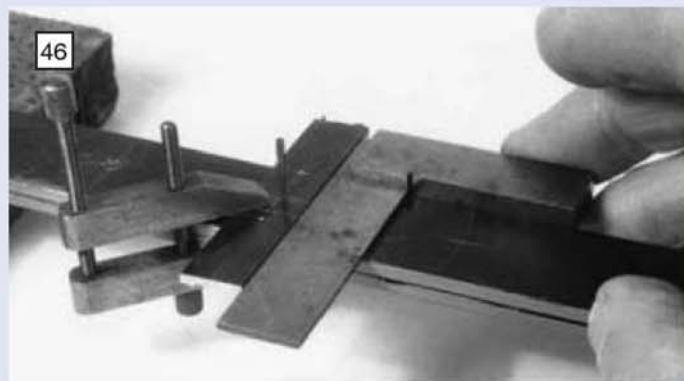
43
Waisting one of the dial pillars.



44
Taper turning one of the spurs.



45
The completed dial pillars and spurs.



46
Checking the squareness of the front bridge piece.

by a couple of thou. to ease the work of the die. In this illustration here the tailstock is not clamped to the lathe bed but is free to move forwards as the work proceeds and the drive belt is unshipped so that the chuck can be turned by hand.

The next stage is to carry out the waisting as demonstrated in **photo 43**. As before, the general purpose brass turning tool is being used with tailstock support and the work is driven by the 5BA spigot in a hollow threaded mandrel. This makes the whole surface of the pillar available for turning and polishing.

Spurs

These are also dimensioned on the drawing (fig 27) and are made from 1/4in. diameter mild steel. To form the taper, you need the top-slide or taper turning attachment. This is incorrectly referred to in the maker's leaflet as the "cross"-slide. The stock is held in the 3-jaw chuck and the top-slide set over 10deg.; this will produce an included angle on the work of 20 degrees. The set-up in the

lathe is illustrated in **photo 44** where the taper is being formed using a cutting tool with top rake.

Machining is continued until the work nearly reaches a point and then a fine file is used to form a 90deg. point which will be stronger than the 20deg. taper. The work is then reversed in the chuck for drilling and tapping the hole at the back end. As I have already mentioned, in these situations the work must be recessed to ensure a secure contact with the face of the cross strut. I illustrate the dial pillars and spurs in **photo 45** ready for assembling on the cross strut.

Front and back bridges

In clock terminology, a bridge is a suspended bearing supported at each end, a cock is only supported at one end. Here there are two bridges in front and behind the plates and these are supported on short pillars. All the dimensions are shown in fig 27.

It will be noticed that the bearing holes in the bridges are shown to be reamed 1/16in., however

clockmakers do not fit bearings in this manner as I will explain later. The procedure here is to mark out both bridges on 1/16in. brass and drill both bearing holes No. 53 size. The two clock plates are now registered together and the holes shown to be 1/4in. in diameter are also drilled No. 53.

The plates are separated and, using the actual drill itself positioned in both the front plate and front bridge, the latter is correctly aligned with the engineer's square as shown in **photo 46**. With the work clamped securely, the pillar holes are drilled No. 42. These are tapped 6BA in the plates and opened out to No. 34 size in the bridge piece. This drilling operation is shown in **photo 47**. The procedure is the same for the back bridge (**photo 48**).

Bridge pillars

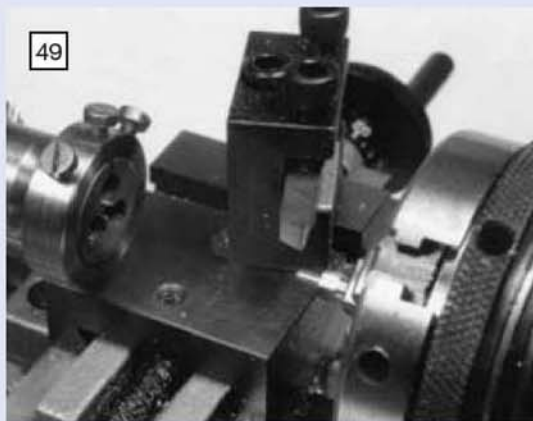
There are four of these, two being slightly longer. It will be noticed that they are machined from hexagonal stock. This is to enable them to be tightened up in the plates with a spanner. If round stock is used then a small tommy bar hole would



47
Drilling the front bridge piece. Second toolmaker's clamp removed for clarity.



48
Using the centre drill to start the holes in the rear bridge piece.

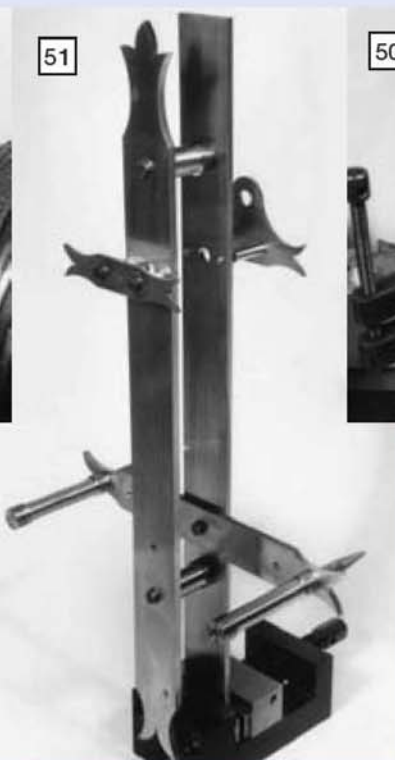


Using the tailstock dieholder to thread a bridge pillar.

need to be cross drilled for the same purpose. The machining of these is straightforward and I show the threading of the spigots in photo 49 where again the tailstock die holder is being used. It is extremely difficult to form a true thread with the die in a hand held diestock.

The final operation in this work is to open up the clearance holes in the plates to $\frac{1}{4}$ in. as shown on the drawing, and I show this drilling operation in the Unimat with the plates held in the machine vice and supported on the home-made internal steps, photo 50. The decoration of the bridge pieces is left to the end as this would inhibit the use of the square when aligning them on the plates.

I show the frame assembly at this stage in photo 51. The parts have not been polished but I have removed the layout blue and generally cleaned up the brasswork by cutting a 2in. wide strip of 220 grit wet and dry paper and wrapping this around a wine bottle cork split lengthways. The paper is used wet and along the length of the various parts.

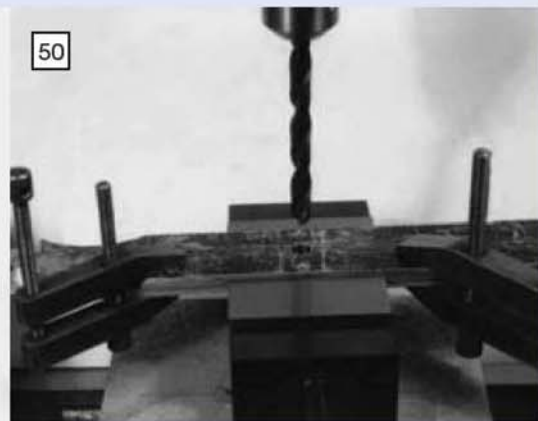


The completed frame at this stage.

On no account should a paper coarser than 220 grit be used as this will make deep scratch marks which will be difficult to remove.

With the frame completed we can start on the compound pendulum and its arbor followed by the 'between the plates' gearing.

I haven't mentioned cutting oils so far. They are not necessary when machining brass of this



Drilling the plates for the $\frac{1}{4}$ in. clearance holes.

type, nor even for tapping and threading. When machining steel, a cutting oil will help in producing a better finish on the work. It can be applied with a small brush in this class of work. Material suppliers can usually provide suitable oils.

When tapping steel, especially in the small sizes and in difficult or hard metals such as silver-steel, special oils are available. I use 'Angel's Breath', a fluid popular with toolmakers. People often write to me asking where they can obtain it. It is difficult to find Angels Breath today, I usually suggest they obtain a large butterfly net and visit their local church!

Reference

(1) The construction of a tailstock dieholder for a small lathe is described in my book *Using the Small Lathe*, which is available from Rite-Time Publishing, 18 Woolmer Way, Bordon, Hampshire GU35 9QF.

●To be continued.

LINING AND LETTERING

David Machin

offers advice on using the purpose made lining tool.

●Part III continued from page 332
(ME 4156, 16 November 2001)

Prepare the paint as suggested earlier, by using a brush, palette and dipper for thinner. For thinner, I use good quality white spirit. I would emphasise *good quality* as some is little better than paraffin. Getting the correct viscosity is *vital*, I can't emphasise this enough, but at the same time I can't give a formula as the quantities are so miniscule. Trial and error is the only answer, and a trial panel is essential. I have found that even with Humbrol paint, a little thinning is needed to achieve the correct flow consistent with an opaque line. I would emphasise a *little* thinner. Mixing can be carried out as previously described, with a brush on a palette.

The nozzle is removed from the handle and the $\frac{5}{32}$ in. dia. hole (which now acts as a reservoir) is filled with paint. Load the lining tool by 'scraping' the loaded brush against the inside of the nozzle. Remember that you're not painting a battleship and very little paint is needed. Have a trial panel ready for testing (and practice!) and if all is well,

lining can commence on the actual job.

For straight lines, a ruler with a small bevel is all that is needed. (Bevel down when lining to prevent paint touching both job and ruler). For lining adjacent to edges, use the edge guide, as shown in photo 25. Here a piece of plate originally made to test the lining tool is shown. It is the same shape as the Allchin hind wheel centre boss. (No prizes for guessing how the actual bosses were lined!) Photograph 26 shows the finished result.

To achieve the correct form for lining where no edges can define the line and which includes

arcs as well as straight lines, a template is necessary. Photograph 27 shows such a template being used; again on a test panel specially prepared for the work. Note the holes that have been drilled for masking tape to hold the template securely. These templates can be made from thin clear plastic sheet, around $\frac{3}{32}$ in. thick. Builders merchants such as Wickes in the UK stock such sheets quite cheaply. For spoke lining on traction engine wheels a reversible template may be used, as shown in photo 28, another Allchin lining tool! By changing the position of the central

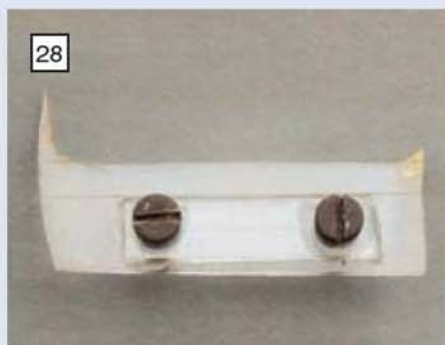


Left: the edge guide is used when the required line is controlled by an edge profile.

Above: finished Allchin hind wheel centre boss.



27



28

Left: a template held down with masking tape is a useful adjunct to the lining process.

Above: a reversible template for lining the Allchin wheel spokes.



29

A signwriter's mahl stick can be used to support the hand wielding the flitch, as here.



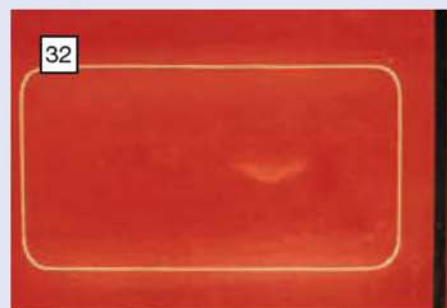
30

The signwriter's mahl stick can also be used to guide the flitch when painting straight lines.



31

A signwriter's mahl stick is easily fashioned from a piece of dowel furnished with a padded end.



32

The completed test piece. The ground colour was left to thoroughly harden before lining began.

guide block from front to rear, the template can be used for both sides of each spoke.

For lining curved surfaces, a flexible template will be required, such as thin polystyrene sheet. This material is used in plastic cladding on houses and is available from suppliers associated with barge board and fascia plastic replacement. Another use for polystyrene sheet in a variety of thicknesses is in vacuum forming, and most secondary schools do this in Technology lessons. Quite a lot is wasted by this process, and they may be willing to give you a piece of the waste cut from a vacuum formed item.

If a slip is made, the line can be removed with a rag moistened in white spirit, and this applies to all the foregoing techniques. This is one reason why the painted surface should be allowed to harden before lining starts.

For wider lines, as pointed out by Martin Wallis in his articles, simply draw two lines and fill between with a brush. However, even this can be difficult unless you have some form of rest to steady the hand holding the brush. Signwriters use a mahl stick (photo 29). Such a stick can be made from a piece of dowel about 1/2in. dia., with a padded end to rest upon and protect the painted surface. Traditionally, this was a piece of chamois leather with padding made from cotton wool.

Another method is to use a wooden 'bridge' over the item being painted, when the latter is flat on the bench. The aim with these devices is always to steady the hand holding the brush, but at the same time to avoid putting the hand on to the painted surface to avoid spoiling previous work. The mahl stick can also be used as a straight edge

to guide the brush (photos 30 and 31). The completed test piece is shown in photo 32.

All these techniques need some practice, of course, and patience of which model engineers

have plenty, so this shouldn't be a problem.

In a later article, Martin Wallis describes a commercially available lining tool and the use of lighter fuel for thinning. At first I thought the use



A real challenge to the finisher's skills, a caravan such as this Reading van by Derrick Hall to a Dunton design c1919 first requires the skills necessary for construction, but more importantly, a very high degree of painting expertise!



Frank Beevers agreed to be a 'guinea pig' and test the equipment and guidance presented in the foregoing notes.



Frank agreed that the tools and procedures work perfectly well but admitted that important factors for success included practice and patience.



The viscosity of the paint used and the attitude of the fletcher to the work were variables which had to be right before success could be assured.



Frank preferred to use a small brush and found it easier to hold it like a pen when applying colour to a wheel mounted on the faceplate.



A wheel and Allchin hind wheel centre boss after Frank had finished his first efforts at lining with the tools and techniques described in these notes.

of lighter fuel as being akin to using paraffin, a heresy not to be encouraged! I have a friend who is a paint chemist, and he said that lighter fuel is okay, but only for the reason that it is much more volatile than white spirit and, as soon as the line is applied, the thinner will quickly evaporate, increasing the viscosity and thereby reducing the risk of the line spreading.

However, he did offer a word of caution: this volatility can lead to a fire hazard if naked flames are near. I have tried lighter fuel as a thinner and can confirm its suitability, with one disadvantage over white spirit. This is that if the lining goes on longer than a few minutes, the lighter fuel starts to evaporate, and one gets problems of flow, and inability to continue lining. I would therefore still recommend white spirit, provided that the correct viscosity is achieved.

Now, I have been saying all along that these techniques are all relatively easy. I asked a fellow model engineer and good friend, Frank Beevers, to try the tools and techniques described in this article, to see if he agreed. **Photographs 33, 34 and 35** show Frank having a go. (Note the test panels in the background in photos 33 and 35).

The following are his conclusions:

"My first observation is that the processes outlined in the article do work. The tools are definitely up to the job and the theory is sound. I would offer several points that the prospective user must keep in mind, as follows:

1: Rome wasn't built in a day. As stated, the tools and theory work, but as with any skill,



Another example of Frank's first efforts, this with a lining pen and thin plastic template.

practice is essential. You won't get it right first time, but if you have a rag soaked in thinner, you can instantly clean off any mistakes and have another go.

2: With the work on the faceplate I found that I preferred to use a smaller brush (a No. 1) and to hold it more like a pen rather than as is shown in photos 9 and 10. Holding the brush at a tangent is also vital.

3: Using the lining tool: the key point, which can't be stressed enough, is that paint viscosity is the most important factor in achieving success. Too thick and it won't flow well; too thin and it flows out from the line you have drawn, leaving a jagged edge. The viscosity is about right when you can blow a blob about the size of a match head without too much effort.

4: The angle of the tool to the work is also very important. It should be upright in relation to the straight-edge or template, and the handle should slope in the direction of drawing, but only slightly. If the tool stutters along, check the angles.

5: Do you move the tool or work? Up to the individual, but I found it much more comfortable and controllable to move the work when necessary to get round corners, particularly when using the edge guide attachment. The key point is to have a go and find out what suits the individual.

6: When filling in with a brush between two lines, I found the mahl stick an encumbrance rather than a help. I also preferred to have the two lines horizontal (shown in photo 35).

7: In the last analysis, you can't go far wrong, because you are never committed to what you have done, unless you let the paint dry."

On Frank's point 2, I have posed a shot to illustrate this, in **photo 36**.

I have photographed the results of Frank's efforts, and should point out that all these trials were carried out in less than two hours, including a return on a later occasion to complete the second black line on the faceplate. So Frank had little time for practice. **Photographs 37 and 38** show his first attempts.

I leave the results to speak for themselves.

Finally, my grateful thanks to Frank for very kindly agreeing to act as a 'guinea pig'. I hope there will be some more guinea pigs out there also willing to have a go! My best wishes for your first attempts.



BURRELL A STEAM TRAM

Marcus Rooks

introduces his model of a steam tram based on only two built by Charles Burrell and Sons Ltd.

●Part I

I first came across the full-size *Burrell*, as I later christened her (no marks for originality I'm afraid), while reading Roland Clark's excellent book, *The Steam Makers of Norfolk*. Although the name Burrell is usually associated with traction engines, they also made a small number of steam launches and steam trams. The book contained an engraving, some bare details and a simple general arrangement. I had been looking for a slightly unusual project for possible commercial development and the appearance of the tram, with its cluster of cooling tubes on the roof, made me realise that I had found what I had been looking for.

Burrell trams

Only two trams were made, one going to the Birmingham Central Tramways Ltd. as No. 71 and the other to the Bradford and Shelf Tramways as their No. 6. Although they were

Burrell in all her glory, if that is the right phrase, painted in the fictional colours of Lerwick tramways. Shetland never had a tramway nor even a light railway. The rear cab sheet has been removed for the driving position and the tap at the bottom of the front sheet is the oil drain valve, adapted from a commercially made cock from an old Bing steam toy.

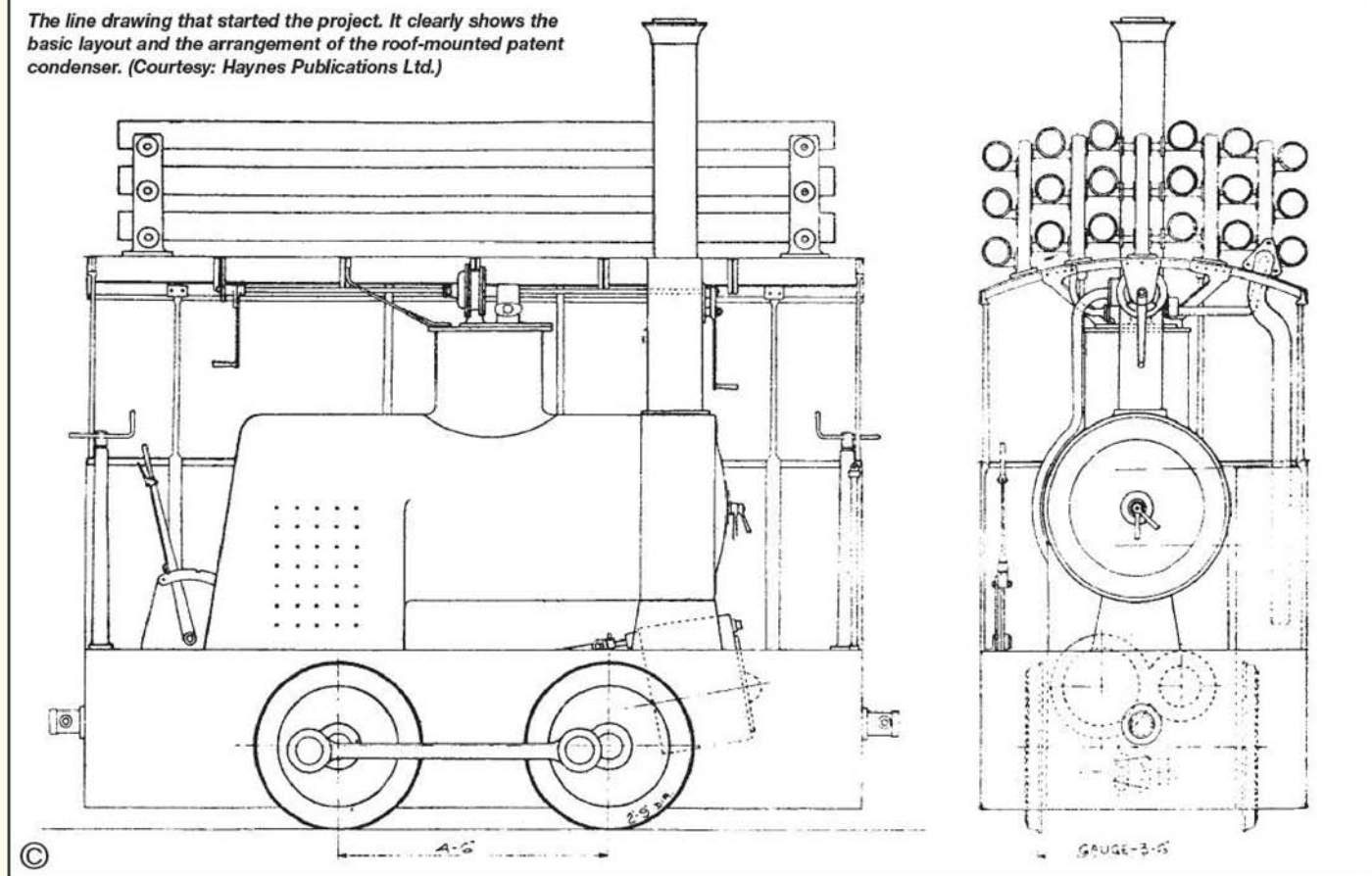
successful in operation, their working lives were not long as all forms of alternative tram succumbed with the advent of electric traction.

They were built for 3ft. 6in. gauge, with 2ft. 6in. dia. wheels and inside compound cylinders operated by Joy valve gear giving a tractive effort of 12,000lb. when they were both worked under high pressure (so called 'double-high'). The boiler

was 3ft. diameter and was rated at a nominal 20hp at 160psi. They were fitted with a patent governor and braking system that kept the speed down to a maximum of 10mph, in accordance with the Red Flag Act then in force. The tram was designed so that it could be operated from either end and possessed extensive glazing that provided the driver with excellent visibility.



The line drawing that started the project. It clearly shows the basic layout and the arrangement of the roof-mounted patent condenser. (Courtesy: Haynes Publications Ltd.)





Left: the PTFE axle boxes bolt directly onto the frames. There are no hornkeeps, although they would be very easy to fit.



Above: two variations of the coupling rods. The top is a conventional type with oil bosses and bronze bushes. The lower is the type actually fitted with PTFE bushes. Both items were CNC marked and laser cut.

The most interesting part of the original tram was the Frederick Burrell patent condenser, comprising a bank of eighteen copper tubes mounted on the roof. Each unit comprised two concentric tubes, the annular space being sealed at each end and the exhaust steam introduced into the space, movement of air through the central bore providing the necessary cooling.

Model

Trams have not been particularly popular prototypes for modelling as they suffer because their operating conditions require the motion work to be concealed. I thought that by combining a series of grilles and cut outs, sufficient of the motion could be made visible. The extensive glazing would allow the rest of the works to be visible so hopefully it would not resemble a shoe-box going around the track.

There are only a limited number of designs for simple electric trams but, as far as I am aware, there are no plans for a steam tram. Rather than starting from scratch, I looked for an established design that could be adapted to my needs; castings and drawings would be available and the design tried and tested. After much searching I came to the conclusion that LBSC's *Tich* seemed to be the best bet. Although possessing outside cylinders and wheels that were slightly too small it was, all in all, the nearest match. As the original ran on 3ft. 6in. track, 1in. scale worked out very nicely for 3 1/2in. gauge.

Burrell makes use of wheels, cylinder, cross-heads, rocker bearings, pump, brake blocks, dome, part of the chimney, smokebox boor and grate castings, the only new casting was for the smokebox. Frames, coupling and connecting rods, motion plates and all body panels were

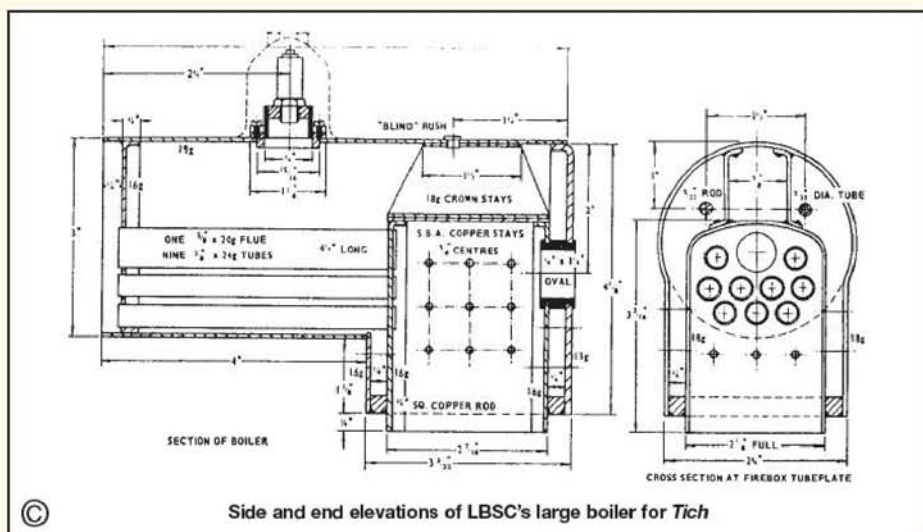
computer marked and laser cut, giving excellent accuracy and finish with the minimum of effort on my part. For ease of construction and cheapness the tram is not sprung, PTFE being used for the bearings, which is very much an experimental procedure; time alone will tell if its use has been a success. The cylinders are set horizontally, making alignment a lot easier but the layout required new motion plates.

Construction of *Burrell* is fairly conventional, but a few items deserve closer examination. Over the years I have seen many rather awkward methods of aligning and fixing the cylinders to the frames. With *Burrell* and similar cylinders, I suggest the following method. Machine two spigots, from scrap mild steel; one to screw into the live steam

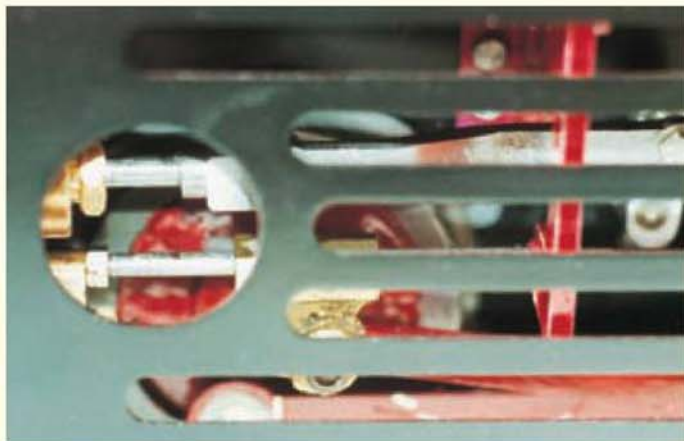
inlet and the other into the exhaust steam outlet. The cylinders are offered up to the frames and held temporarily in place by the spigots. The frame/cylinder assembly can then be transferred to the drilling machine and the frame holes transferred to the cylinders. They are tapped 6BA and the holes in the frame opened up to 6BA clearance. Simple!

If by any chance the live steam and exhaust holes in the cylinder do not match the holes in the frame, do not panic. Use the spigot for the exhaust to hold the cylinder to the frame and use a square from the top edge of the frame to the front of the cylinder, the holes can then be transferred as before.

●To be continued.



Side and end elevations of LBSC's large boiler for *Tich*



A detail of the motion as seen through the side skirts, designed not only to make the motion visible, but also to gain access for oiling and maintenance.



A close-up view of the brake gear. The large hole over the brake hanger is for the ash-pan dump pin.

Colin Pape

describes the configuration of the linkage and begins work on the cylinder components for his model of this unusual engine.

●Part II continued from page 326
(M.E. 4156, 16 November 2001)

To help understand how Evans' solution works I have represented the critical parts of his mechanism in fig 2. This sketch represents the engine with the beam in the horizontal position and in the position it takes when pushed up by the piston.

Let us start off with the beam horizontal. Point A represents the axis of the pivot of the radius link at the machine frame; A is fixed. Point B represents the pivot point of the radius link on the beam; B moves with the beam. Point C represents the support end of the beam where it is joined to the rocking column; C too moves with the beam. Directly behind A is the pin connecting the piston rod to the beam.

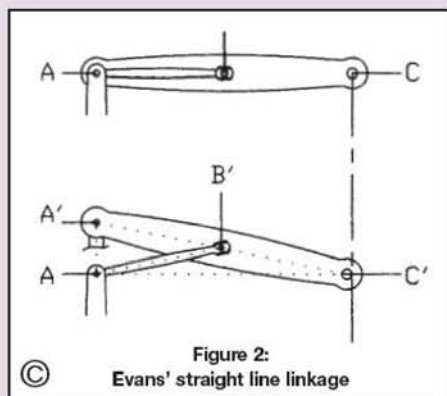
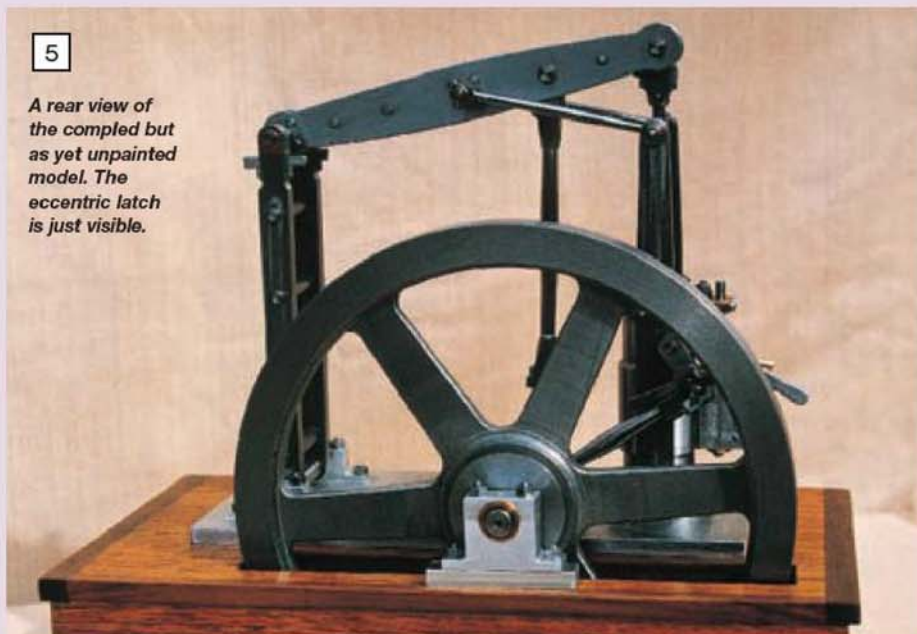


Figure 2:
Evans' straight line linkage

When the piston end of the beam has moved up, its new position is at A'. The line A-A' represents the travel of the piston rod. At the same time that the piston has pushed the beam up, the beam end of the radius link has also moved up but not linearly. It can only move in an arc of a circle. Its new position is at B'. The support end of the beam C, has been drawn towards the piston rod. Its new position is at C'.

To understand what sort of path the piston end of the beam has followed, we have to do some geometry. We need to look at two triangles. One is formed by the lines A-B', B'-C' and A-C' and the other is formed by the lines A'-B', A-B' and A-A'. I have shown these lines dotted. If we take the apex of each of these triangles to be at point B' it is clear that the sum of the two apex angles is 180 degrees. From this we know that the sum of the other four angles of the two triangles is also 180 degrees. The angle at the junction of the line representing the piston rod and the horizontal line through the piston end of the beam is the angle A'AC' and is composed of one base angle from each of the isosceles triangles. If the piston rod is to travel vertically this angle must always be 90 degrees. It will always be 90 deg. if the two triangles are both isosceles because in this case the angle will always have a value of half the sum of the four base angles, i.e. $180 / 2 = 90$ degrees.

A rear view of the completed but as yet unpainted model. The eccentric latch is just visible.



OLIVER EVANS' HALF-BEAM ENGINE

Critical dimensions

To ensure that the two triangles are isosceles, the following two conditions must apply:

- 1: The effective length of the radius link must be half the effective length of the beam.
- 2: The pivot of the radius link on the beam must be halfway between the piston end of the beam and the support end.

Additionally, if the cylinder is set vertically then the support end of the beam should be at the same height as the fixed end of the radius links.

I don't know how Evans actually implemented his invention. The only picture I have found of his engine is an engraving and no detail is visible. It appears that the frame of the engine is largely made of wood.

The German machine was built about 40 years later. It is an all-metal engine and one can actually look and even touch. In this engine there is a very precise adjustment system for the radius link length. This adjustment is in the form of eccentric bushes in the ends of the radius rods. There is no evidence from the museum machine of an adjustment system for the height of the beam support pivot.

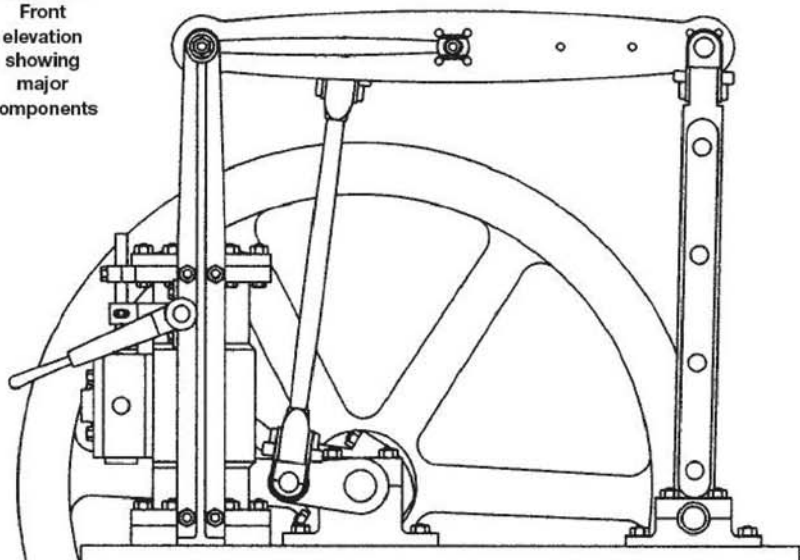
Ideally, the support end of the beam should move horizontally in a straight line. If it did there would be no errors at all in the linearity of the piston rod travel. However, this end of the beam is subject to forces in the up as well as the down direction so the design would require some sort of very precise horizontal slot which would be subject to unequal wear. Making this slot may have posed problems to the primitive sorts of workshop machines to which Evans would have had access, and there would have been maintenance problems. If the end of the beam could move in a slight arc it could be restrained using simple cylindrical pivots. Simple pivots are much easier to make than precise slots. We must sup-

pose that Evans did the calculations and found that a support column that moved in a slight arc would give very good results. In fact the engraving shows that the end of the beam rests on a rocking column of only about half the required height. The column base sits on what appears to be a heavy wooden frame.

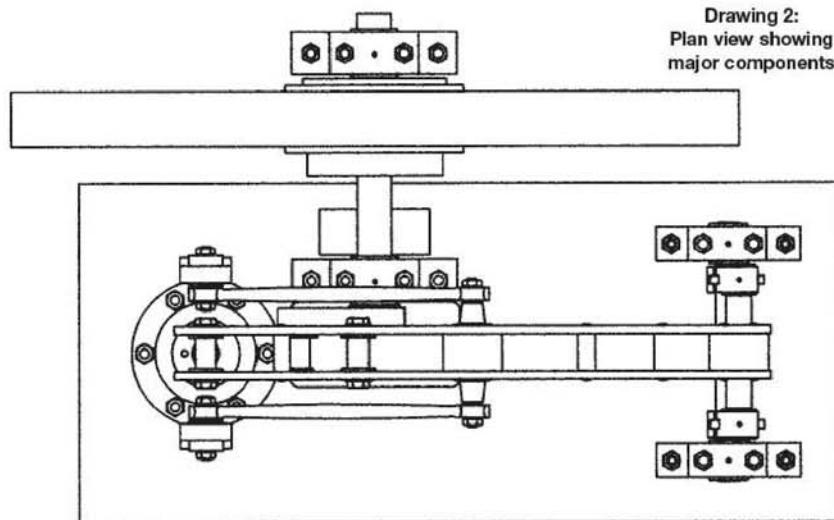
By the time that the German engine was built it was probably quite easy to make a good solid slot mechanism but they did not bother. Calculations show that it is not really necessary. Based on the estimated dimensions of the museum engine I could calculate that the beam support column moves through an arc of about 1.33 degrees. The maximum difference in height of the pivot as it moves in its arc is about 0.47 millimetres. This leads to a maximum horizontal error of approximately 0.1mm at the piston end of the full-sized engine.

Concerning this error, it is interesting to design the model so that the error is zero when the beam is closest to the cylinder. If we assume that the beam support pivots are at the same height as the radius link support pivots when the rocking column is vertical, then the best case is to have the column vertical when the beam is fully down and fully up, and not when it is horizontal. The engine should be set up so that there is zero error when the beam is closest to the cylinder. In this case the maximum error occurs at two points, at roughly one third travel and at two thirds travel. If the beam is set for zero error at the horizontal position and with the column vertical at this point, there will be maximum error when the beam is fully down (very bad) and when it is fully up (not so bad). The surprising thing is that the maximum error in this case is four times what it is in the previous case. I will probably never find out if Evans knew about this or not but the German builder seems to have

Drawing 1:
Front
elevation
showing
major
components



Drawing 2:
Plan view showing
major components



known. I can see from a photo that I took of the real engine that the rocking column appears to be vertical when the beam is at its highest and lowest. In the model it would not matter if we had the column vertical when the beam was horizontal but for the sake of realism I have followed the approach of the real engine.

Model

Once I felt that I knew how the engine was supposed to work I decided to draw up some plans to make a working model.

The finished but unpainted model is shown in **photo 5**. Except in three minor respects, this model was built according to the drawings accompanying this series of articles. I have reduced the screw sizes in the bearing pedestals to 8BA from 6BA; I have altered the shape of the eccentric strap and changed the design of the guard on the eccentric link. With the new guard, when the eccentric link is unlatched, the main shaft can be turned through a complete cycle without causing the valve crank to move.

The scale of the engine as I have represented it, is about 1:15. This size was determined by the size of the piece of cast iron that I used for the

flywheel construction. I used the 2kg weightlifter disk shown in **photo 5**. It was good value at 16 French francs (about £1.60) in my local hypermarket. The model engine described here does not pretend to be a scale model of a specific half-beam engine. It is intended to be a reasonable representation of this type of engine.

There is no reason why the dimensions I have shown should not be altered as long as the critical relationships are observed. If significant changes are made to the proportions you may care to leave the definition of the piston stroke until you can establish it by experiment from the rest of the model. It is not a straightforward calculation to determine the exact relationship between the crankshaft throw and the piston travel. This is because the various parts of the beam and the connecting rod move in different ways as follows:

- 1: To all intents and purposes, the supported end of the beam moves in a straight line horizontally.
- 2: The piston end of the beam follows in a straight line vertically.
- 3: The crankshaft end of the connecting rod describes a circle but the other end moves in an arc of an ellipse.

Drawings

This model was designed entirely using a computer aided design (CAD) system. I never used a pencil and paper. I am a novice at CAD but I have found out how to assemble a 'virtual' engine. Having drawn a piece it is possible to move it around and join it to other pieces and build up sub-assemblies. Similarly, sub-assemblies may be moved around and joined together to produce a complete mechanism.

I assembled the complete engine in drawings showing it from different views. I found this exercise to be very effective in finding problems with dimensions and interference. When I actually started to cut metal for the model the only times that I had to re-make a part were when I made a mess of the machining operations.

A CAD system will give you incredible precision and you can work in the metric or imperial systems. I have a metric workshop so I use the metric system in my drawings. I was specifying dimensions to 0.01 of a millimetre until I realised that I was giving the impression that it was important to work to 0.0004 of an inch. This is a bit pretentious; I am only a hobby machinist. Accordingly, I have limited myself in most cases to giving dimensions to 0.1 of a millimetre. This could cause some misunderstanding. For example, where I show a shaft of 4.0mm to be fitted in a bearing of 4.0mm I assume that the reader will understand that the shaft cannot have the same dimension as the bearing.

Drawing 1 is the General Assembly drawing of the engine as seen from the same side that is visible in the case of the Munich exhibit. The beam is shown in the horizontal position so the rocking column is not vertical. **Drawing 2** is a view from the top showing the major components.

Drawings 3 through **13** are the individual part drawings. I made these drawings life size for my own use. The parts are quite small and the drawings tended to get a bit cluttered when I attempted to indicate all the hidden features by using proper hidden detail lines. When the drawings are reproduced in the magazine they are even smaller so in many cases these indications have been omitted.

Construction

The engine described does not use any castings. Everything may be fabricated from stock material. Most of the material that I used for this project is shown in **photo 6**. Some 6mm flat steel and some bronze rod are not shown. The weightlifter disk is cast iron and was used to make the flywheel. The rounds are free cutting mild steel; the strip is mild steel. The studding is 8BA, which is the size of most of the fastenings. I haven't found a way to avoid the use of the smaller BA screws! Bronze was used for the piston and the more important bearings. Aluminium alloy was used for the base plate, the valve chest and the bearing pedestals. I would have used it for most of the model had some more been available.

These materials are adequate for a model that runs on compressed air.

If the model is to be run on steam then cast iron should be used for the cylinder parts and a drain cock connection should be fitted in the cylinder base.

The basic engine can be built with hand tools and a lathe. Oliver Evans could very well have



Most of the components for the writer's model were prepared from this group of materials. The large red cast iron weight became the flywheel.

constructed his engines this way. There are no special machining requirements. Milling operations are only really required for cosmetic purposes.

I have not made any provision for adjusting the length of the radius rods in the model. I made a simple jig to drill the important holes in the beam and the radius links.

The following notes describe how I made some pieces to an acceptable standard for the model. You may be able to think of better ways of making the parts!

Cylinder components

These are grouped in drawing 3. The cylinder, the cylinder base and the cylinder head may be made from one piece of 36mm dia. round bar.

The round stock should be held in the lathe chuck and left there, if possible, for all of the machining on the cylinder components. A 3-jaw chuck is perfectly adequate. Initially, the outer end of the stock should be supported on a centre, and then in a fixed steady.

This stock will be used in the following order. The outboard end will be the cylinder bottom plate, the next section will be the head, and the long section next to the chuck will be the cylinder itself.

Start by turning the stock to the cylinder flange diameter then turn down the cylinder main barrel sections. The reason for the fat section of the barrel is simply to provide extra wall thickness so that the fixing holes for the valve chest will have sufficient depth. Aim for a good finish on the reduced portion of the cylinder towards the outer end because this section will be the support when the fixed steady is used. Next, start the parting-off process for the different sections. Take the cut below the level of the future flats. While the tailstock centre is still in use put the fixed steady into position to set the three support fingers. Next prepare the flats on the cylinder flanges and the head and bottom plate. The flats may be filed *in situ* or milled. Take the job to the milling machine, if you have one, but keep it in the chuck. You will need to slide the fixed steady out of the way as you remove the chuck. The flats on the future cylinder head section should be about 0.1mm deeper than the others so that the head can be removed easily. While you are making flats you might as well prepare the flat for the valve chest. It is also a good idea to drill the holes in the flats. All the holes will then be perpendicular to the flats. Photograph 7 shows the cylinder components still as one piece in the chuck.

Back on the lathe, support the work with the fixed steady on the reduced portion of the cylinder. If the workpiece has moved slightly in the meantime, the steady will bring it back into line. Finish the outer end surface of the cylinder bottom



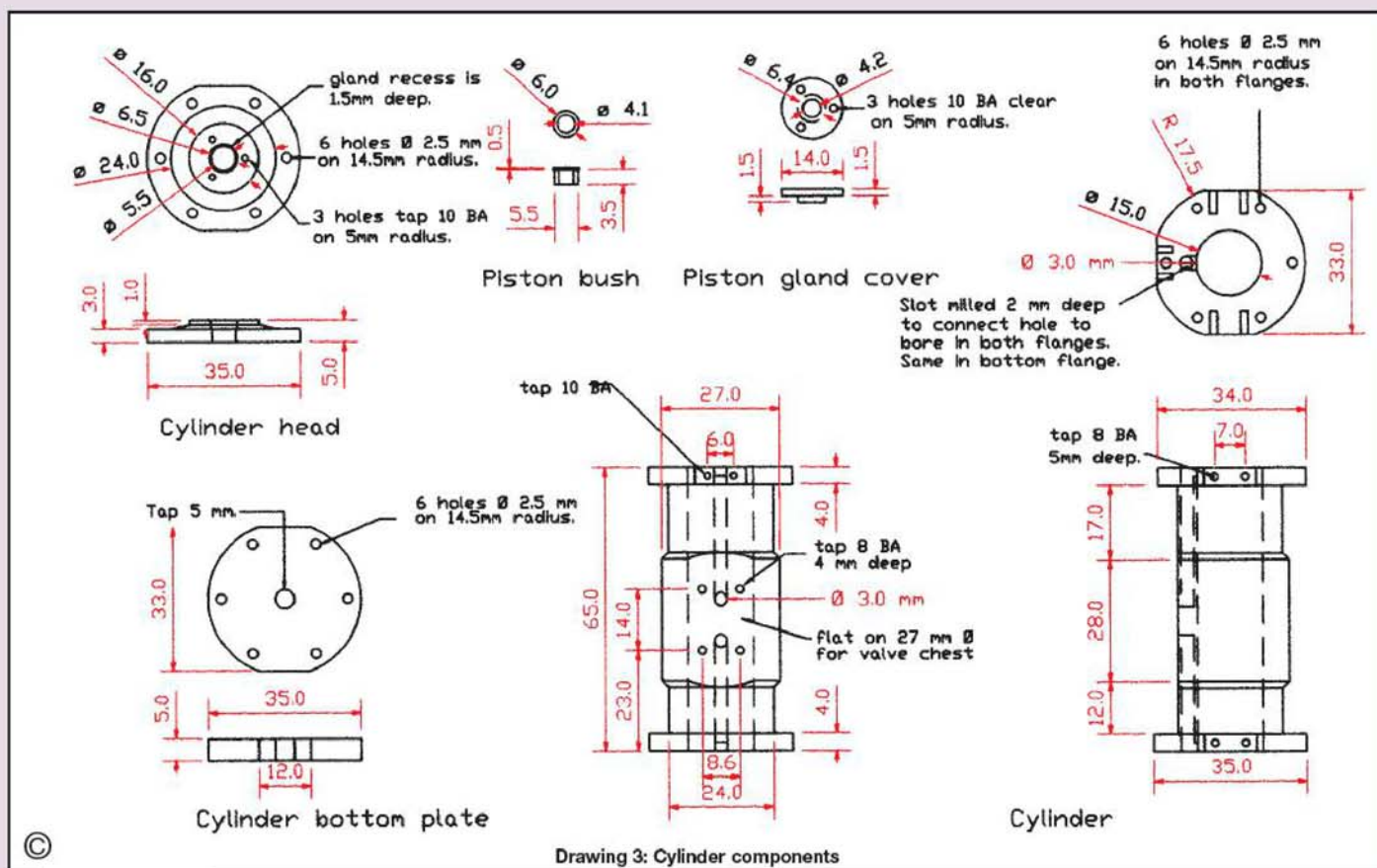
The cylinder components were machined as a group, leaving the stock material undisturbed in the 3-jaw chuck for as long as possible.

plate and drill and tap the hole for the drain plug or drain cock connection. If you can do off-centre drilling in the lathe, now is a good time to drill the holes for the six screws that go through the cylinder base and the cylinder head and the top cylinder flange. If you plan to use the cylinder bottom plate as a template for drilling the fixing holes in the bottom flange of the cylinder and the engine base plate, then only drill for 8BA tapping at this stage. Make sure that the holes are correctly positioned relative to the flats. Part off the cylinder bottom plate.

It is now possible to work on the new outer end to prepare the top surface of the cylinder head and to bore the hole for the piston rod gland. Part off the cylinder head.

Now the cylinder is exposed and can be rough bored right through or even finished but you may prefer to finish the boring using a boring bar as a separate operation. It will be honed later. Part off the cylinder.

●To be continued.



TRADE TOPICS

Engineers tools from Planet Manufacturing

Planet Manufacturing has supplied engineers tools for over twenty years. A new catalogue listing their products is now available and is free to readers. For your copy contact Planet Manufacturing, Unit 11, Dyffryn Enterprise Park, Pool Road, Newtown, Powys, SY16 3BD; tel: 01686 62 62 60



Battle of Britain Class 257 Squadron, the Streamliners, *Evening Star* and many, many more. There is exclusive interview footage with Dr. Beeching and an evaluation of some of the early diesel and electric locomotives that killed off the golden age of steam.

RAIL 175 also takes the opportunity to review all the best railway anniversary festivals of yesteryear including the Rail Centenary 1925, the LMS Centenary in 1939, the RAIL 150 event in 1975, the 125th Anniversary of Paddington Station in 1979, the Rainhill Trials event in 1980 and the amazing Barrow Hill Steam Occupation of the Roundhouse in 1999. There's rare archive footage, previously unavailable newsreel material and more.

RAIL 175 is available in all good video stockists price £12.99 and copies are also available by mail order from DD Video, Unit 1, Pool Bank Business Park, High Street, Tarvin, Chester, CH3 8JH, priced £12.99. Please include £1.75 per cassette towards postage and packing. Credit card customers can also

order copies by ringing the 24 hour DD Video hotline on 01829-741490.

New range of waterslide transfers in 5in. gauge from Phoenix Precision

Phoenix Precision has recently announced the introduction of a new type of 5in. gauge waterslide transfer to their range of products. The transfers are available in a wide range of styles to suit most popular model locomotive applications

These transfers differ from all other transfers available to model engineers in that the varnish coat is the last layer to be printed. Once applied to the surface, the transfer is left for 24 hours to fully adhere. The varnish coat is then carefully removed using low tack masking tape. This leaves the design on the surface looking as if it has been printed there with no 'halo' of varnish to mar the surface.

Similar ranges for 7 1/4in. and 3 1/2in. gauge will be introduced and plans are in hand to expand the range of designs in all scales. The pair of large BR post-1956 crests



illustrated cost £6.50 (inclusive of VAT plus £1 post and packing). Further information is available from Phoenix Precision Paints Ltd., P.O. Box 359, Cheltenham, GL52 3YN; tel/fax: 01242- 575326; e-mail sales@phoenix-paints.co.uk; web-site: www.phoenix-paints.co.uk

Electric motors from Motors Direct

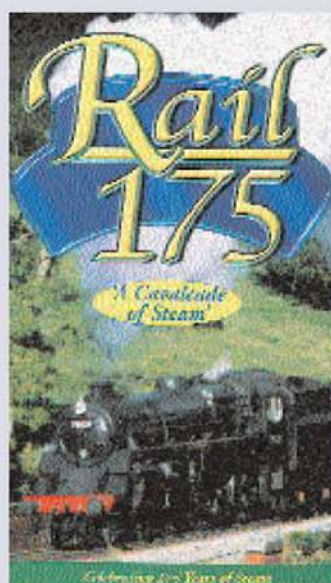
We have received details of some of the electric motors offered by this company which specialises in supply-



ing difficult-to-source components to electrically-minded hobbyists and machine builders. The first example is a Type 23 stepper motor suitable for X-/Y-axis control in computer numerically controlled machines or similar applications. These are 1.8deg. (x200 per rev.) type and run 3volts/1.8amps per phase. They have a 7/8in. long x 1/4in. dia. shaft with a flat and require control via a suitable driver board and computer program, but are offered at £24 per pair, which is the normal price for one.

The second example is a 220volt AC motor and gearbox assembly. The gearbox ratio gives a speed of approximately 60rpm at the 3/8in. dia. output shaft (the actual speed is 56.96rpm but is voltage dependent). With a low stated output of 25 watts, the motor uses only 1/2amp and is continuously rated. It is supplied with a cooling fan and a 5µF capacitor. This unit is offered at £45 inclusive of postage and packing.

Further details of these and many other special offers are available from Alastair Graham, Motors Direct, Harvester Yard, Ditcheat, Nr. Shepton Mallet, Somerset, BA4 6RB; tel: 01749 860111.



Rail 175 - The Official Video from DD Video

One of the biggest and best steam events of 2000 was RAIL 175, held on the North Yorkshire Moors Railway. A glorious gala of preserved British steam locomotives, it was held to celebrate the historic 175th anniversary of the Stockton and Darlington Railway.

Earlier this year, DD Video released the official video of this historic occasion, packed with Britain's top preserved locomotives in full steam including *Sir Nigel Gresley, Hartland, George Stephenson, Blue Peter, Green Knight, Furness No. 20* and Southern 828 *Harry A. Firth*. All are extensively featured on this video together with exclusive interviews.

This important anniversary is the perfect time to look back over the history of steam railways in Britain, and RAIL 175 takes the viewer back on a fascinating journey from Trevithick and Stephenson through Brunel and Gresley to Beeching and Pegler. Other locos featured include Trevithick Locomotive No. 1, *Locomotion No. 1, Rocket, Sans Pareil, Lion, Stepney, Hardwicke, City Of Truro, Flying Scotsman,*

CLUB CHAT With Stan Bray

UK News

When we last heard, the rack railway of **Friends of Beamish Model Engineering Group** was nearing completion, the museum having generously donated all the necessary ballast material. Special loading arrangements for locomotives have also been constructed to enable models to be easily transferred from cars to the railway. Since the museum required an area of land on which part of the Friends' 'normal' track was situated, to facilitate the erection of a new large exhibits building, this track has been out of service for a while. The building houses a number of large engineering artefacts from the North East, including a magnificent 140 ton Doxford engine. Surplus soil from the foundation of the building has been used to strengthen the club's embankment and all waste material from the building work has been retained for future use by the society. The club is anxious to attract new members and anyone interested in this very go-ahead organisation should contact them through Beamish Museum (call: 01207-23811).

After six years in the post, Doug Crampton, Secretary of **Peterborough SME** announced at the AGM that he wished to retire from the position in order to devote some time to model engineering. Following a vote of thanks for his past efforts, the meeting unanimously elected Tony Meek to the position. Tony can be contacted at 10 Mossop Drive, Langtoft, Lincolnshire PE6 9LY; tel: 01778-345142; e-mail: tony@meek2.freemove.co.uk The society will be supporting the Tallington Traction Engine Rally, if it takes place in 2002, and will also be staging their usual event at the Sacrewell Farm Museum.

With a journey of well over 300 miles, 16 members of **Bradford SME** made the largest contingent of representatives from any single society at the 7 1/4 in. Gauge Society AGM which was held at Beer in Devon in September. The meeting is as much a social as a formal occasion and everyone had a very enjoyable weekend, or in some cases, an entire week. When a decision was made to check the insurance on the clubhouse, which they had always believed to be insured by the local authority that owns the building, members (of Bradford SME) were disturbed to discover that this was not the case and a very hasty telephone

call had to be made to the Northern Ass'n. ME in order to get it insured. Following an

appeal by a local school for some assistance in advising and teaching engineering techniques to pupils, three club members have volunteered to help and who knows, some of the youngsters may even get the model engineering bug.

In recent months, three burglaries with the resultant loss of precious items have plagued **Northampton SME**. On the first occasion the thieves removed a padlock from the station building and stole a battery operated drill owned by a member, and two-way radios. They took the padlock with them so members were left wondering if the intention was to have a key made so they could easily gain entry to all the other buildings. Needless to say, all locks were promptly changed. Undeterred, the thieves returned and broke into the station building once again, this time taking a strimmer, leaf blower and socket set. They failed to gain access to the clubhouse, although it was obvious they tried a number of methods of doing so, including the removal of slates from the roof in an attempt to get through that way. As a stop-gap measure, the doors were welded shut until members could install extended padlock guards and again fit new locks. A few days later the culprits returned and made a really determined attempt to get into the clubhouse; this time they succeeded and stole a video recorder and some food. Yet more new padlocks were required! A further attempt was made two days later but this time they were unsuccessful as the doors had been strengthened and metal grilles fitted to all windows. The local police were very helpful and an alarm has been temporarily installed on one of the buildings. It is a sad state of affairs however, and one which has cost the society a considerable amount of money. Regrettably, they are not the only club affected in this way. It is therefore beholden on all societies to ensure their premises are as secure as possible. Of course, all this effort has meant that members of **Northampton SME** are now a long way behind with their planned winter working schedule. Despite this, they still anticipate having the new traverser completed and the steaming bays roofed over in time for the new running season.

North Norfolk MEC have completed their track extension and now have an out-and-back run of around 920 feet. This takes them beyond the limit of the **Bure Valley Railway**



platforms and as far as the signal box. There is a telephone system along the entire length of the track, and work is progressing on a traverser to allow the changing over of trains without any manhandling. The Environmental Health Officer has advised them that complaints have been received from a resident or residents, concerning 'excessive noise' with the result that passengers may no longer be carried except on days when there are special events on the Bure Valley Railway. It is hard to believe that a miniature passenger carrying railway makes more noise than their landlords, the Bure Valley Railway, and so two members are making audiometer tests at various locations in the expectation that the Environmental Health Officer can be provided with evidence in support of their case.

Regular readers will be aware that in addition to their established raised track for 3 1/2-5 in. gauges, **Reading SME** now has a new ground level track for 5-7 1/4 in. gauges in Prospect Park, Bath Road, Reading, Berkshire (see M.E. 4153, 24 August 2001). Details of running sessions appear in *Club Diary* and we understand that members of other model engineering societies are very welcome to visit with their locomotives on these dates to run them, subject of course to the usual requirement for a valid boiler certificate. There is ample parking on site and refreshments are available. For further information contact Graham Bustin on 0118-961-5450.

A rally devoted entirely to models of locomotives of the London & North Western Railway, organised by **Erewash Valley MES**, proved to be even more successful than anticipated. On arrival on a warm and sunny day, each participant was invited to place his model on the steaming bays which became an impressive exhibition area, and then to partake of refreshments in the clubhouse. These must have been particularly good because it was some considerable time before drivers emerged to steam their models. A total of 12 engines included a few which were models of locomotives of companies that were constituent parts of the London & North Western Railway. The meeting

was held in conjunction with the **London & North Western RS**, which was present with a sales stand and a tent displaying all manner of LNWR memorabilia. A number of books were included on the sales stand, and author Edward Talbot was on hand to sign some for the purchasers. At the end of the rally Mr. Lowe of the **LNWRS** presented all participants and the (EVMES) society with a replica of the Crewe Medal struck in 1887 to commemorate Queen Victoria's Golden Jubilee, the dedication of Queen's Park in Crewe, the completion of the 30,000th locomotive at Crewe Works and the 50th year of the railway at Crewe.

With the participation of 26 members with their wives and families, **Bromsgrove SME** organised a trip to Germany at the end of August. The fourth international trip the club has undertaken, the occasion this time was the annual **Sindelfingen MES** Steam Festival on an impressive 3 1/2, 5 and 7 1/4 in. gauge ground level track plus a rail to make up 127mm gauge for good measure. Members (of Bromsgrove SME) took 10 locomotives with them and, with warm, sunny weather, plenty of time for running, and the excellent hospitality for which German societies are noted, it need hardly be said that an excellent time was had by all. The trip was not entirely confined to model engineering activities; on the outward journey a Rhine Cruise was enjoyed and, during the stay at Sindelfingen, a member of the host society acted as guide for a coach tour of part of the Black Forest area. The return journey was via Luxembourg and Brussels, giving the party an opportunity for shopping and sightseeing. Subsequent society meetings have been devoted to viewing photographs and videos of the trip, and planning is already under way for the next of these biannual adventures. The club normally operates at the **Avoncroft Museum of Buildings** with monthly meetings at the Ladybird Inn, Finstall, and we are told that new members would be very welcome. Anyone interested should contact Mr. J. Lamb, 15 Churchill Avenue, Droitwich Spa, Worcestershire



From the archives: Bert Mead shows the late Sir Yehudi Menuin 'how it works'.

WR9 8NP for further information.

Two Rallies for visitors and members are scheduled in the Nottingham SMEE 2002 programme. The first is to be held on 21 April, so intending visitors may wish to begin making their arrangements soon. The second is on 7 July and an interesting snippet from the programme is that no fewer than four *Thomas the Tank Engine* days will be held in June, replacing the normal public running days. The track is situated in the Heritage Centre at Ruddington where the monthly meetings are also held, and anyone requiring further information about these or other society matters should contact Graham Davenport (call: 0115-849-6703) while further information about events on the track may be had from Gerry Chester (call: 0115-925-9096).

Flooding has once more been a major problem for Tonbridge MES, and considerable thought has been given to methods for future avoidance of the considerable damage caused by flooding. Members have consulted with local building companies to determine the best ways of avoiding the problems and, although at one stage it was anticipated that the workshop would have to be raised by several feet in order to keep it clear of rising water, an easier solution has been determined. The interior has been lined with easily removable aluminium alloy panels which, should the situation recur, will not only help to keep flood water out, but can also be removed to allow the structure to dry out if the worst comes to the worst. All wooden storage facilities have been replaced with metal ones set more than 4ft. above the floor, this being the height to which the last flood waters rose. Also, a concrete block has been cast *in situ* on which the lathe is set to keep it clear of any water that might get in. The club has been included on the list of those to receive advance warning of any future flooding, to enable them to take such precautions as may be considered suitable to protect the property. Finally, a day was set aside to load a skip with the remaining damaged items and rubbish caused by the last flooding. All this has of course taken

considerable time and energy, but it has not entirely prevented the members from enjoying themselves. A particularly notable trip was to the Moors Valley Railway where they were allowed full access to all the facilities including the opportunity to drive some of the locomotives.

A very special event for which the club headquarters was packed to capacity, was recently organised by North London SME to celebrate the 90th birthday of long-standing member Bert Mead. In the style of the popular television programme *This is Your Life*, Mike Crisp took the part of presenter *a-la* Michael Aspel or perhaps even Eamon Andrews. After exploring Bert's life, augmented by recollections from Bryan Luxford and Naughton Morgan, and hearing innumerable anecdotes from Bert himself in his own inimitable style, the evening concluded with wine and nibbles plus a splendid birthday cake specially made for the occasion by Ena Morgan. Bert Mead's name may not be particularly familiar to many readers, but in North London and South Hertfordshire he is not only extremely popular, but is also a legend having built several very fine models throughout his lifetime. Somewhat introvert, Bert has never sought fame, but has spent the majority of his life promoting the hobby in his own quiet way, and there are many who must be grateful for the help and assistance he has given them. In the meantime, we mustn't forget other facets of the society, and the fact that the marine section seems to be going from strength to strength since the pond was completed and commissioned. Another marine section Open Day in September attracted even more visitors than the last one, with a number of societies represented. A very successful competition was closely fought, joint winners being David Morgan from the home society and Tony Frost from Hertford Model Boat Club.

In Memoriam

It is with the deepest regret that we record the passing of the following members of model engineering societies. The sympathy of staff at *Model Engineer* is extended to the family and friends they leave behind.

Terry Hammer
 Jim Mercer
 Archie Spanner

North London SME
 Wigan & District MES
 Isle of Wight MES

In preparation for the very wet winter forecast, members of Isle of Wight MES have installed a pump in a sump set into the drainage system. It is connected to the electrical circuit via a level switch that detects the rising water and switches the pump on. The water is then pumped into the boating pond and, if necessary, can overflow into the surrounding area with a minimum of damage to the club facilities. During 2001 much work was carried out on the area surrounding the track and in laying a base for a new store, members having long ago lost count of how many tons of concrete they have mixed up. All they know is that the large pile of ballast used in its preparation never seems to get any smaller! It is quite obvious that someone keeps the supply topped up until all the work has been completed! Somewhat more popular than mixing concrete is the modified barbeque which is now really efficient and, together with the picnic tables that have been installed, is proving its worth.

The committee members of Wigan DMES were joined for their September meeting by the Manager of Haigh Country Park, where the society has its track, and Lewis Parry the Health and Safety Officer for Wigan Metropolitan Borough Council, the latter only just having become aware of the activities of the society. Many pertinent questions regarding safety aspects of club activities were asked, and hopefully Mr Parry departed satisfied with the answers he received. The society held a Diesel and Electric Day in June which attracted 13 locomotives, and a Narrow Gauge Locomotive Rally in September which saw a number of visiting locomotives in operation as well as a lot of people who just went along to view the proceedings. The society has finally decided to dispose of its locomotive, a *Charlatan*, to any member who wishes to purchase it.

The Maxitrak Owners Club AGM was combined with a Factory Open Day at Staplehurst in Kent and was attended by some 30 members. It was reported that the society was unable to accept any more applications for the visit to Sinsheim in Germany, the coach being fully booked. The full membership of the society now stands at 287, many being from overseas. This was amply

reflected at the annual rally when one of the first members to arrive was Juan Bededialuneta from Bilbao. Many others travelled long distances within the UK to make it one of the most successful events the society has ever held.

The National 2 1/2" Gauge Ass'n (Southern Area) End-of-Season Get-Together was held at Hook, as usual, with a slightly reduced number of people attending than previously, believed to be due to severe road congestion, about which there had been previous publicity. On the table was the LBSC Memorial Bowl won this year by Peter de Salis Johnston who was also presented with the society Memorial Trophy in recognition of all the work he had carried out on behalf of the Association during the previous year. A number of other locomotives were present and the range of castings was on view. There is a steady increase in membership of the Association with a member from as far away as Australia included amongst the latest list.

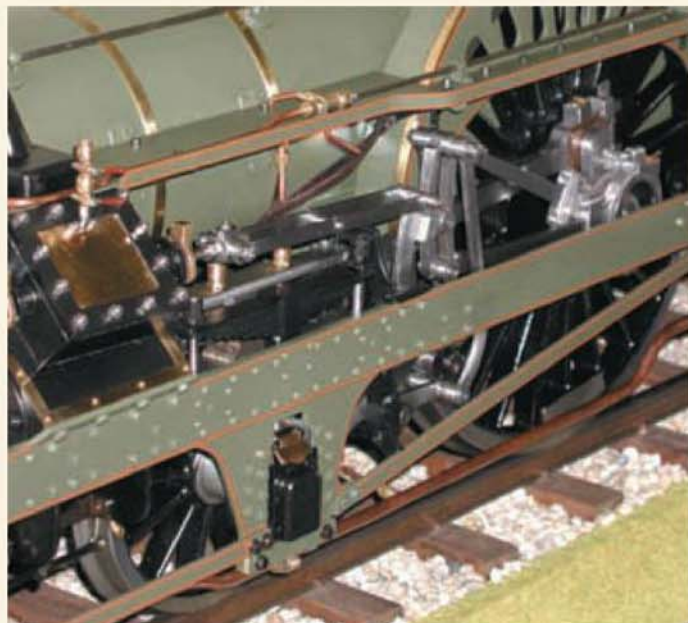
The Leighton Buzzard Narrow Gauge RS reports a considerable number of recent changes to the railway with alterations to the track layout at both Page's Park Station and Stonehenge Works, much of which is related to strengthening work in anticipation of taking into operation the Matheran locomotive, restoration of which is nearing completion. Visitors will be able to see more of the very popular displays of specialist wagons at Stonehenge Works and there is now a craft shop at the station which will also supply refreshments. Everyone was very pleased during the summer to welcome to the railway the Club President, Sir William (Bill) McAlpine whose efforts in preserving steam locomotives, traction engines, etc., are legendary. During his visit he spent a great deal of time talking to members and discussing at length the preservation of the Baldwin locomotive and he agreed to become President of the Baldwin Appeal. The opportunity was taken for him to welcome Simon Ratcliffe, the latest volunteer to work on the railway, and to promote the new souvenir guide book which gives a great deal of information about the railway and its locomotives and rolling stock, much of which could be of interest to modellers building narrow gauge prototypes. It is available either by post for £2.45 or from the railway for £1.95. Write to Page's Park Station, Billington Road, Leighton Buzzard LU7 8TN.

CLUB DIARY

A minimum of 6 weeks notice is required for diary entries. Clubs and Societies are asked to include a telephone number for the assistance of would-be visitors.

DECEMBER

- 14 Colchester SMEE. Christmas Meal. Contact L. G. Hammond: 01376-511686.
 14 Hereford SME. Christmas Party. Contact John Arrowsmith: 01432-265151.
 14 Historical MRS (Essex Area). Members' Meeting - Bring Along Your Latest Project. Contact Jem Harrison, 27 Colne Place, Basildon, Essex SS16 5UZ.
 15 Erewash Valley MES. Santa Special. Contact Jim Matthews: 01332-705259.
 15 Fylde SME. Club Stand at G-Wizz Exhibition. Contact Alan Reid: 01253-882872.
 15 Historical MRS (Bristol Area). Peter Gray: South Devon Branches. Contact Gerry Nichols: 01117-973-1862.
 15 Historical MRS (Scottish Area). Members' Social Afternoon. Contact Richard Crockett: 01896-750730.
 15 Horneby ME. Santa Visits Xmas Party. Contact Ted Gray: 9484-7583.
 15 Reading SME. Club Running. Contact Graham Bustin: 01189-615450.
 15 SM&EE. Christmas Party. Contact David Boote: 01202-745862.
 15 Sutton MEC. Christmas Party. Contact Mike Dean: 0208-657-5401.
 15 York City & DSME. AGM. Contact Ken Bateman: 01904-421445.
 15/16 Vale of Aylesbury MES. Santa's Magic Steamings. Contact Clive Ellam: 01296-623433.
 15/16 Leighton Buzzard NG Rly. Santa Specials. Enquiries: 01525-373888.
 15/16 Tallylyn Railway. Santa Specials. Enquiries: 01654-710472.
 15-23 Saffron Walden DSME. Christmas Running. Contact Ken Archer: 01763-852911.
 16 Birmingham SME. Childrens' Christmas Party. Contact John Walker: 01789-266065.
 16 Chichester DSME. Santa Specials. Contact Brian Bird: 01243-542266.
 16 Erewash Valley MES. Steaming Day. Contact Jim Matthews: 01332-705259.
 16 Frimley & Ascot LC. Santa Run. Contact Bob Dowman: 01252-835042.
 16 Harlington LS. Mince Pie Run. Contact Peter Tarrant: 01895-851168.
 16 Tallylyn Railway. Carol Train (7pm) Enquiries: 01654-710472.
 16 York City & DSME. Running Day. Contact Ken Bateman: 01904-421445.
 17 Horneby ME. Meeting. Contact Ted Gray: 9484-7583.
 17 Leicester SME. Model Night. Contact Raymond Wallis: 0116-285-8824.
 18 Chesterfield MES. Meeting: Slide Show. Contact Mike Rhodes: 01623-648676.
 18 Northampton SME. Christmas Drinks. Contact Pete Jarman: 01234-708501.
 18 Nottingham SMEE. Christmas Get-Together and Bits & Pieces. Contact Graham Davenport: 0115-8496703.
 18 Stafford DMES. Quiz & Mince Pies. Contact Chris Dobbs: 01889-270533.
 18 Taunton ME. Social Night. Contact Don Martin: 01460-63162.
 19 Birmingham SME. Festive Food Night. Contact John Walker: 01789-266065.
 19 Chingford DMEC. Cheese & Wine Evening. Contact Martin Masterson: 0208-989-3051.
 19 MELSA. Meeting. Contact Graham Chadbone: 07-4121-4341.
 20 Cardiff MES. Club Chat. Contact Trevor Jenkins: 029-20755568.
 20 Isle of Wight MES. Nostalgia Night No. 25: Film Show & Buffet. Contact Ken Stratton: 01983-760762.
 20 Leyland SME. Christmas Dinner & Dance. Contact Alan Wilson: 01942-715072.
 20 Sutton MEC. Quiz Night. Contact Mike Dean: 0208-657-5401.
 21 Canvey R&MEC. Christmas Get-Together. Contact David A. Clark: 01375-846921.
 21 Colchester SMEE. Quiz & Fizz Evening. Contact L. G. Hammond: 01376-511686.
 21 Rochdale SMEE. Bits & Pieces. Contact Mike Foster: 01706-360849.
 21 Romford MEC. Bring & Buy Sale. Contact Colin Hunt: 01708-709302.
 21 Romney Marsh MES. Video Evening. Contact John Wimble: 01797-362295.
 22 Bournemouth DSME. Luscombe Valley anti-Shopping Weekend. Contact Mike Baker: 01202-383653.
 22 Chesterfield MES. Running Day. Contact Mike Rhodes: 01623-648676.
 22 Isle of Wight MES. Christmas Special Track & Pond. Contact Ken Stratton: 01983-760762.
 22-24 Vale of Aylesbury MES. Santa's Magic Steamings. Contact Clive Ellam: 01296-623433.
 22-24 Leighton Buzzard NG Rly. Santa Specials. Enquiries: 01525-373888.
 22-24 Tallylyn Railway. Santa Specials. Enquiries: 01654-710472.
 23 Ascot LS. Members' pre-Christmas Steam-Up. Contact Tony Alderman: 01932-854393.
 23 MELSA. Bracken Ridge. Contact Graham Chadbone: 07-4121-4341.
 25 Bedford MES. For Anyone Who Dares - Santa Steam-Up. Contact Alan Guildersleve: 01525-383010.
 26 Canvey R&MEC. Boxing Day Morning Steam-Up. Contact David A. Clark: 01375-846921.
 26 Cardiff MES. Boxing Day Steam-Up. Contact Trevor Jenkins: 029-20755568.
 26 Colchester SMEE. Boxing Day Steam-Up. Contact L. G. Hammond: 01376-511686.
 26 High Wycombe MEC. Boxing Day Steam-Up. Contact David Savage: 01494-527402.
 26 Leyland SME. Boxing Day Mince Pie & Steam-Up. Contact Alan Wilson: 01942-715072.
 26 Maidstone MES. Boxing Day Run. Contact Martin Parham: 01622-630298.
 26 Malden DSME. Boxing Day Steam-Up. Contact J. Mottram: 01483-473786.
 26 Stockholes Farm MR. Boxing Day Running. Contact Ivan Smith: 01427-872723.
 26 Sutton MEC. Boxing Day Run. Contact Mike Dean: 0208-657-5401.
 26 Tonbridge MES. Boxing Day Run. Contact D. C. Brunning: 01732-352153.
 26 West Wiltshire SME. Boxing Day Steam-Up. Contact R. Nev. Boulton: 01380-828101.
 26/27 Leighton Buzzard NG Rly. Mince Pie Specials. Enquiries: 01525-373888.
 26-1 January Tallylyn Railway. Christmas Train Service. Enquiries: 01654-710472.
 27 Cardiff MES. Club Chat. Contact Trevor Jenkins: 029-20755568.
 27 Staines SME. Steam-Up. Contact Mike Kingham 01932-788793.
 27 Sutton MEC. Natter Night. Contact Mike Dean: 0208-657-5401.
 29 Basingstoke DMES. Christmas Run. Contact Ian Shanks: 01420-561741.



Detail of Gerard Veenhuizen's superb 7 1/4 in. gauge Crampton locomotive France which was awarded a Gold Medal at MEX 2000. Come along to this year's event at Sandown Park Exhibition Centre, Surrey, 29 December 2001 - 1 January 2002 to discover more magnificent models.

- 29 - 1 January Nexus Specialist Exhibitions. 71st Model Engineer Exhibition at Sandown Park Exhibition Centre, Surrey. Admission: Adult £6, Senior Citizen £5, Child £2. Fri-Sun 10.00-17.00, Mon 10.00-16.00. Contact Andrea Colyer: 01322-660070.
 30 Elmdon MES. Steam-Up. Contact Chris Giles: 0121-458-1291.
 30 MELSA. Sunday in the Park. Contact Graham Chadbone: 07-4121-4341.
 30 Reading SME. Running. Contact Graham Bustin: 01189-615450.
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 1 Taunton ME. Social Night. Contact Don Martin: 01460-63162.
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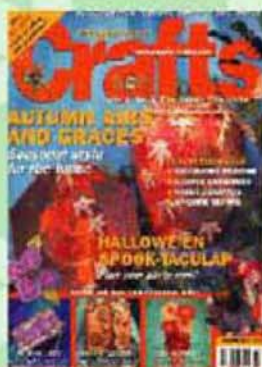
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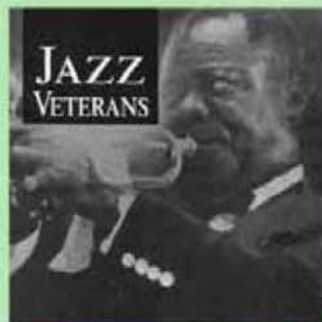
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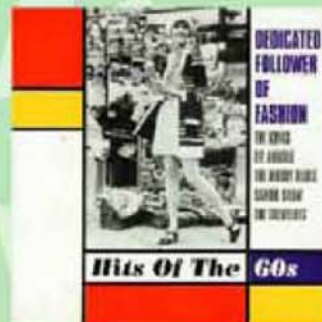
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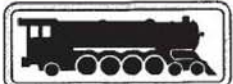


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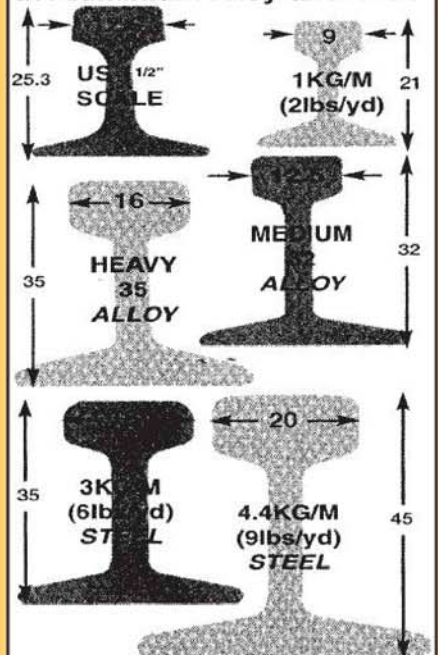
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- SWING OVER BED: 229MM
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- MOTOR: 1/2HP
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- NET WEIGHT: 100KG

- STANDARD EQUIPMENT:
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 - MT3 DEAD CENTRE
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 - FACE PLATE
 - TOOL BOX & TOOL KIT
 - TRAY & SPLASH GUARD



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- SWING OVER BED: 420MM
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- TAILSTOCK BARREL TRAVEL: 80MM
- 7 SPEEDS 60-1300
- SWING OVER CROSS SLIDE: 160MM
- SPINDLE TAPER: MT3
- DRAW BAR: MT2
- CROSS SLIDE TRAVEL: 180MM
- MOTOR: 1/2HP
- NET WEIGHT: 155KG
- STANDARD EQUIPMENT
- 4" 3-JAW CHUCK
- 2 DEAD CENTERS
- 1/2 DRILL CHUCK
- CHANGE GEARS
- MT3 CHUCK ARBOR



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Comet Lathe

- SWING OVER BED: 250MM
- SWING OVER CROSS SLIDE: 133MM
- DISTANCE BETWEEN CENTERS: 550MM
- SPINDLE BORE: 19MM
- TAPER IN SPINDLE NOSE: MT3
- MOTOR: 1/2HP
- 6 SPEED: 125-2000
- NET WEIGHT: 130KG
- MILL ATTACHMENT
- SPINDLE TAPER: MT3MM
- HEAD TRAVEL: 215MM
- SPEED VARIABLE
- RANGE: 0-30000i
- MOTOR: 1/2HP
- NET WEIGHT: 45KG

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Centurion

- SWING OVER BED: 420MM
- DISTANCE BETWEEN CENTERS: 520MM
- MILL DRILL SPINDLE TAPER: 19MM
- TAILSTOCK BARREL TRAVEL: 80MM
- 7 SPEEDS 160-1360
- SWING OVER SADDLE: 160MM
- SPINDLE TAPER: MT3
- DRAW BAR: MT2
- CROSS SLIDE TRAVEL: 200MM
- MOTOR: 2 x 1/2HP
- NET WEIGHT: 230KG
- STANDARD EQUIPMENT
- 4" 3-JAW CHUCK
- 2 DEAD CENTERS
- 1/2 DRILL CHUCK
- CHANGE GEARS
- MT3 CHUCK ARBOR



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Craftsman Precision Belt Drive

- SWING OVER BED: 300MM
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- SWING OVER SADDLE: 170MM
- DISTANCE BETWEEN CENTERS: 570MM
- SPINDLE BORE: 36MM
- SPINDLE NOSE TAPER: MT5
- CROSS SLIDE TRAVEL: 150MM
- COMPOUND TRAVEL: 89MM
- TAILSTOCK BARREL TAPER MT3
- TAILSTOCK BARREL TRAVEL: 92MM
- RANGE OF SPEEDS: 50-1250RPM
- MOTOR: 11/2 HP
- NETWEIGHT 398KG

STANDARD EQUIPMENT:

- 6" 3-JAW CHUCK WITH REVERSIBLE TOP JAWS
- 8" 4-JAW CHUCK WITH REVERSIBLE TOP JAWS
- STEADY REST • FOLLOW REST
- STAND • 12" FACE PLATE
- SPLASH GUARD • THREADING DIAL
- 4-WAY TURRET TOOL POST
- 3MT DEAD CENTERS
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Cub 620/630/640

- SWING OVER BED: 300MM
- SWING OVER GAP: 430MM
- SWING OVER SADDLE: 174MM
- DISTANCE BETWEEN CENTERS: 500/750/1000MM
- BED WIDTH: 190MM
- SPINDLE BORE: 38MM
- SPINDLE NOSE: D1-S
- SPINDLE NOSE TAPER: MT5
- CROSS SLIDE TRAVEL: 160MM
- COMPOUND TRAVEL: 75MM
- TAILSTOCK BARREL TAPER MT3
- TAILSTOCK BARREL TRAVEL: 70
- RANGE OF SPEEDS: 9 60-2000RPM
- NUMBER OF INCH THREADS 33
- RANGE OF INCH THREADS 4-72 TPI
- MOTOR: 11/2HP 240V PR. 2HP415V
- APPROX SHIPPING WEIGHT 380KG

STANDARD EQUIPMENT:

- HARDENED AND GROUND GEARS IN HEADSTOCK
- BUILT-IN STAND
- FOOT BRAKE
- MOUNTED LIGHT
- INDUCTION HARDENED BEDWAYS
- FACE PLATE
- JOG BUTTON AND EMERGENCY STOP
- 4-WAY TURRET TOOL POST
- 6" 3-JAW CHUCK WITH 2 PIECE TOP JAWS
- 8" 4-JAW CHUCK
- STEADY REST / FOLLOW REST
- 2 DEAD CENTERS
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